

HAND BOOK FOR DAIRY ENTREPRENEURS & FARMERS

**Unlocking The Standard
Operating Procedures For
Dairy Farms.**



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Contents

1. INTRODUCTION.....	5
1.1 Objective & Scope	5
1.2 Good and Profitable Dairy Farm Management.....	5
1.3 Good Dairy Farming Practice	6
2. ESTABLISHMENT OF DAIRY FARM	10
2.1. Preparatory Stage for Dairy Farm Establishment.....	10
2.2. Internal Shed Design.....	15
2.3 External Shed Design	19
2.4 Types of Dairy animal Housing	26
2.4.1 Features of Loose Housing System	27
2.4.2 Conventional Housing System	28
2.5 animal Shed Components	30
2.6 Legal/Regulatory formalities	39
2.7 Plan of animals	39
2.8 inducting a New animal.....	40
2.9 Sourcing of animals	43
2.10 Financial Plan - Financial Linkage	43
2.11 Purchase Plan.....	44
2.12. Security Measures to Protect the Farm, animals, and Equipment.....	46
3. DAIRY FARM- OPERATIONAL MANAGEMENT.....	50
3.1 Breeding Management.....	50
3.2 Drying-Off an animal.....	51
3.3 Factors affecting Breeding Efficiency	54
3.4 Management Practices to Improve Breeding Efficiency	55
3.5 Selection Methods.....	56
3.6 Systems of Breeding	60
3.7 artificial insemination	61
3.8 Package of Practice to Improve Reproductive Efficiency.....	63
4. DAIRY NUTRITIONAL MANAGEMENT.....	65
4.1 Nutritional Requirement of Cows	65
4.2 Classification of Feedstuffs	71
4.3 Roughages.....	73
4.4 Tmr-Importance	77

4.5 Hay Making	81
4.6 Silage Making	83
4.7 Transition Management (Dry Cow to Milking)	90
5. ANIMAL HEALTH MANAGEMENT	94
5.1 Preventive Health Management for Nutritional Related Issues	94
5.2 Ketosis.....	95
5.3 Milk Fever	96
5.4 Bloat.....	98
5.5 thelitis	99
5.6 Preventive Health Management for Non-Nutritional Issues.....	100
5.7 Care of Calf and Cow at Birth	105
6. ANIMAL WELFARE MEASURES IN DAIRY FARMING	110
6.1 Checklist for animal Health Management	110
6.2 Transport of animals.....	114
7. MILK PROCUREMENT – TESTING THE MILK TO ASSESS THE FAT AND SNF.....	117
7.1 Purpose of Clean Milk Production.....	117
7.2 Clean Milk Production.....	117
7.3 animal Hygiene	117
7.4 Milkers Hygiene	118
7.5 Utensils or Equipment Hygiene.....	118
7.6 Hygiene During Milking Process.....	118
7.7 Environmental Hygiene	119
7.8 Important Tips While Milking	119
8. SUSTAINABLE FARMS	121
8.1 Uses of Cow Dung.....	121
8.2. Collection of Cow Dung (Manure) and Cleaning by Washing	122
8.3 Effective Disposal and Utilization of Manure	122
8.4 Economic Viability	123
8.5 Farm Yard Manure (Fym).....	125
8.6 Composting	125
8.7 Vermicomposting	125
8.8 organic Mulch	126
8.9 Establishment of Biogas and Bio-Slurry Unit.....	127
8.10 advantages of Biogas Production	127
8.11 Components of Biogas Plants	127

8.12 Site Selection	128
8.13 Bio-Slurry	128
8.14 Operational instructions for the Bio-Slurry Unit (Small Farmer with 2-3 Cows)	129
8.15 Leakage Checking Steps:	129
8.16 Comparison of Bio-Slurry(B) to Farm Yard Manure(Fym)	129
8.17 Bio-Slurry as a Fertilizer	132
8.18 Value added Products Based Out of Manure.....	132
8.19 Waste Reduction and Recycling initiatives.....	133
8.20 Energy.....	133
8.21 Energy Efficiency	133
9. STANDARD WORKPLACE PROCEDURES FOLLOWED IN A DAIRY FARM	134
 9.1. Routine activities of a Dairy Farm	134
 9.2 Daily Routine Milking.....	134
 9.3 Monthly Routine	134
 9.4 Quarterly or Yearly Routine	134
 9.5 Schedule of Daily Farm Operations.....	135
10. STAY UPDATED (CONNECT WITH WHATSAPP GROUPS / INFORMATION PLACES)	137
 10.1 Staying Updated on advancements in Dairy Farming Technology and Practices	137
 10.2 the Benefits of Data-Driven Farming.....	137
 10.3 Technology Solutions for Dairy Farms	138
 10.4 Getting Started with Data-Driven Farming.....	138
 10.5 automated Milking Systems	139
 10.6 Precision Feeding.....	139
 10.7 Environmental Monitoring	139
 10.8 Collaboration with agricultural Research institutions	140
11. RISK MANAGEMENT AND SUCCESSION PLAN	141
 11.1 Identifying and Mitigating Potential Risks in Dairy Farming	141
 11.2 Risk Management.....	141
 11.3 Business Vs Financial Risk	142
 11.4 External Vs internal Sources of Risk.....	142
 11.5 Risk in Short-Term and Long-Term Decisions	143
 11.6 Good and Bad Risks.....	143
 11.7 Crisis Management Strategies	144
 11.8 analysing Risk in Farm Management.....	145
 11.9 Biosecurity as a Risk Management Strategy.....	146

11.10 Safety /Security /Insurance Coverage	147
11.11 insurance of the Livestock	148
Retagging.....	149
11.12 Cattle & Livestock insurance Policy	149
11.13 Prohibition of Rebates.....	152
11.14 Succession Planning	152
11.15. Training in New Technology Driven activities.	163
11.16. Employee Wellness and Motivation.....	164
12. FINANCIAL PLAN	166
12.1. Financial Management	166
12.2. Record Keeping -Mis – Data Capturing formats/Practices	168
12.3. Types of Records to Be Maintained at a Dairy Farm	169
12.4. Financial Records- Cash Flow, income, Expense Statement Profit and Loss a/C of the Farm	172
12.5 Cost of Production	176
12.6 Farm Working Expenses (Fwe)	177
12.7 total Operating Costs (Toc).....	177
12.8 assets, Liabilities, and Equity	178
12.8 Preparing a Balance Sheet.....	179
12.9 Capital Gain.....	179
12.10 Depreciation	180
12.11 Stock inventory Management Register:.....	180
13. ANNEXURES:	182
13.1 Tagging Method:	182
13.2 Method of Tag Number:	182

DAIRY FARM MANAGEMENT- STANDARD OPERATING PROCEDURES

1. INTRODUCTION

Dairy Plays an Important Role in Sustaining Livelihood, Nutritional and Environmental Security and Growth of Indian agriculture. Dairy Is the Single-Largest Agricultural-Commodity in India That Contributes 5% to the National Economy Producing Over one-Fifth of Global Milk Production. India Is the World's top Producer and Consumer of Milk. the Structured and Primarily Unorganised Portions of the Indian Dairy Sector, Each account for 75% of the Market.

India Produced 198.4 million tons of Milk in 2019–20 with a Population of Nearly 300 million Cattle. the Phenomenal Strides Made in the Dairy Sector in the Past Decades Contributed to the Positive Growth Rates in the agricultural Sector. India Has achieved an Export Value of Rs 1,358.29 Crores of Dairy Products for the Years 2020–21, with the UAE Serving as the Country's Largest Dairy Sector Export Market.

Butter Exports Have Reached 15,000 Metric tons in 2022, a 36% increase above the Revised 11,000 Metric tons Export total for 2021. India Exports Value-Added Dairy Goods Such as Milk Powder, Milk albumin, Butter, Butterfat, Cheese, infant Food Preparations, and Spreads.

Majority of Milk Producers in India are Small or Marginal Farmers, Necessitating the adoption of Scientific Practices for increased Productivity and Sustainability. the Handbook on Scientific Dairy Management Practices addresses Farm Management, animal Husbandry (Including Breeding, Health Care, Nutrition, Fodder Production, and Manure Management), and Financial Management for Profitable Dairy Operations.

The Handbook aims to Equip Dairy Farmers with Necessary Knowledge and Procedures to Optimize Productivity and Profitability Through Scientific Practices.

1.1 Objective & Scope

- **Objective:** the Document aims to Serve as a Farmer-Oriented Guide for Profitable Dairy Farm Management, Ensuring Safe Practices and Production of Quality Milk from Healthy animals Through Scientific Management.
- **Approach:** It Outlines Key areas to Be Managed Proactively by Dairy Farmers, Specifies Desired Outcomes, Identifies Critical Hazards, and Provides Control Measures to achieve Objectives.
- **Scope:** This Sop Serves as a Resource for Dairy Farmers, Relevant to their Farming Systems, Emphasizing Safe, Quality Milk Production, Sustainable Management Practices, and Holistic Considerations of animal Welfare, Social, Economic, and Environmental aspects.
- **Key areas:** the Sop Covers animal Health, Milking Hygiene, Nutrition, animal Welfare, Environmental Considerations, and Socio-Economic Management, offering Guidelines and Measures for achieving Desired Outcomes in Each area.

1.2 Good and Profitable Dairy Farm Management

Dairy Farming Is a Highly Profitable Business If Managed Properly. Some of the Factors That Contribute to the Profitability of a Successful Dairy Farm are:

- **Quality of the Dairy Breed:**

The Quality of the Breed Is one of the Most Crucial Factors in Dairy Farming. Dairy Farmers Should invest in High-Quality Breeds That Promise High Milk Yielding Potential and are Disease-Resistant That are Best Suited for Local Climate and Conditions.

- **Proper Breeding Practices:**

Dairy Farmers Should Implement Proper Breeding Practices to Ensure That their Cattle Produce High-Quality Milk Yielding off-Springs and to Improve the Genetics of the Herd. This includes Selecting the Right and Robust Bulls for Breeding, Keeping accurate Records, and Managing the Breeding Process Efficiently.

- **Proper Nutrition:**

High Quality Feeds are Essential for the Productivity and Health of the Cattle. Farmers Should Provide their Cattle with a Balanced Ration to Meet all their Nutritional Requirements.

- **Good Herd Management:**

Good Herd Management includes Regular Monitoring of the Health of the Cattle, Proper Housing, and Proper Hygiene Practices to Maintain Healthy and Productive animals.

- **Efficient Milking Practices:**

Investing in Modern Milking Equipment or Training the Workers on Proper Hygienic Milking Techniques are Efficient Milking Practices That are Essential to Maximise Milk Production and Minimise Waste.

- **Marketing Strategies:**

Creating a Good Brand Image, Efficient Networking with Prospective Buyers and Promoting Through Social Media Campaigns.

- **Cost Management:**

To Maximise Profits, Costs Should Be Managed Effectively by Reducing Wastages, Optimising Feed and Labour Costs, and Minimising Expenses.

- **Maintenance of Records:**

To Track Profitability and Identify areas for Improvement, accurate Records of the Cattle, their Milk Yield and Expenditures Should Be Maintained.

- **Business Planning:**

Developing a Business Plan That Manifests the Goals, Strategies and Financial Projections Will assist the Farmers in Making informed Decisions and Manage the Business Effectively.

- **Continuous Learning:**

Embracing New Technologies, Practices and Trends in the Dairy industry Is Paramount to Improve the Skills and Stay Competitive.

1.3 Good Dairy Farming Practice

The Principal Objective of Good Dairy Farming Practice Is to Produce Safe, High-Quality Standard Milk from Healthy and Robust animals by Implementing Sustainable Management approaches in Terms of animal Welfare, Social, Economic, and Environmental Perspective. to achieve the Objective, Farmers Need to adopt Best Practices in the areas Mentioned Below.

- Animal Health
- Milking Hygiene
- Nutrition (Feed and Water)
- Animal Welfare
- Environment
- Socio-Economic Management

2. Establishment of Dairy Farm

Below are the Important Points to Consider Before Establishing a Dairy Farm

- Conducting a Thorough assessment of the Value of the Land/Property That Is intended to Use for Dairy Farming Should Be the Primary Objective Before Starting any agricultural Enterprise. the Opportunity Cost of the Land (I.E. Potential Earning Capacity of the Land or Property If It Needs to Be Used for Other Business –Other Than Dairy) and Future Value (E.G. Value of the Land in Next 5 Years) are Important Parameters for an informed Decision Regarding investment (More Particularly on Fixed assets Like Housing Etc.) in Dairy Farming. It Is advisable to Set aside Some Land for Fodder Cultivation (For 10 Cows Depending Upon the Soil, Rainfall, Irrigation Facilities, Land Required Varies But 1.5 – 2.0 acres). one Should also assess Personal Expectations and Try their Best to Understand the Scale of Operation Vis a Vis Earning from Dairy Farming. Farming with Live animals Is a Full-Time Operation, and one Needs to Sacrifice Many Things in Life. for instance, one Cannot Easily Go for a Holiday with Family Leaving a Herd of animals to the Supervision of a Caretaker Unless and Until the Caretaker Is a Skilled Person and Trustworthy. Similarly, Like in Other Businesses It Is Not Easy to Stop Operations for a Day or Two as Farming Demands Daily activities.
- It Will Be Helpful to Read available information on Dairy Farming (Including Model Bankable Projects) in India in General and one's Own State in Particular. It Is always Better to Plan Operations with Fewer animals and Expand with Experience. one Should Note That High-Yielding animals Demand More Care, Proper Nutrition, and a Better Environment in order to Remain Productive. Many Farmers Suffer Huge Losses When They Purchase High Yielders and Fail to Give Required Care, Nutrition (Fodder and Feed), and Environment (E.G. Housing, Etc.)
- Visiting any Local Dairy Farm / Cooperative Dairy Society / Self Help Group Near the Proposed Location of Your Farm to Take First-Hand information about the Business, More Particularly about the Source of Good animals, Suitable Breed, Veterinary Services, and Market, Etc Will Be of Tremendous Help. the Selection of Breed of animal Can Depend on the Preference of the Majority of Successful Farmers in Your area. one Should Preferably Buy animals from Nearby Known Farms instead of from Cattle Markets. However, a Visit to a Known Cattle Fair May Be Useful When animals are Not available Nearby or Just to Know the Output of Various Breeds, available Technology, and average Prices.
- Visiting the Local Veterinary Department office or Krishi Vigyan Kendra (Kvk) or office of the State institute of Rural Development (Sird) Can Be informative, to Explore If any Training, Project formulation, Bank Linkage and insurance of animals, Etc. are available. the Guidelines and availability of these Things Vary from State to State in India.
- If the Proposed Farm Falls Under a Milk Cooperative or Private Milk Processing Unit, the officials of the Concerned organisation Will Provide instructions on all aspects in Setting Up the Farm with the Understanding That they Will Get a Supply of Raw Milk in Turn. in Those areas Where there are No Cooperative or Private Dairy Processing Units, one Can form Self-Help Groups with Other Farmers, Seek Government Help (Contact the Dairy Development Department of Your State) for Setting Up Milk Cooling Centres to aggregate Milk from Various Farms, and Collectively Market the Same to Distant areas.
- It Is Strongly Recommended for one to Decide on Dairy Farming only in Such Localities Where there are Other Farms and Quality Support Systems Like, Suppliers of inputs, Veterinary Facilities, Marketing arrangements, Etc. Otherwise, one Can Talk to Some of

the Neighbours and Encourage them for Dairy Farming. More Production in any Locality Will attract Service Providers and Milk Quantity too Will Be Sufficient for Marketing in Distant areas or Value-Added Processing.

- Prepare the Project Report (One May Take the Help of Bank Suggested Consultants and ask the Bank Manager for Reference.) and approach Nationalised Banks for Financial assistance with Government Subsidy Under Venture Capital and Other Schemes. Note That NABARD Banks only Refinance I.E. one May Have to approach a Nationalised Bank Who in Turn Will Determine the Eligibility for assistance Under the NABARD Scheme. Generally, Credit Limit Depends on one's Own Financial Standing and Feasibility of the Project in the Chosen Location. Bank Is the Best organisation to Guide on This. always Communicate with the Bank Through appropriate Channels and Keep a Record of these Communications. a Scheduled Bank Should Not Refuse any application without Giving Due Details in Writing Regarding the Ground for Refusal.
- The Project Report Is the Most Important Document, and It Is advisable to Understand the Report Thoroughly. Planning, Record Keeping, and Mid-Course Correction (If required) are Essential.
- A Local Veterinarian of the Concerned District or Dairy Farm Consultant associated with the Local Bank Will Can Be approached for His Service, Such as Guidance to Design the Farm Site, Select Good animals for Purchase, Plan for Fodder Cultivation, Etc. there are innovative Ways to Go for Less Costly But Comfortable animal Housing. in Some Parts of the Country, a Loose Housing System Has Recently Gained Much Popularity as It Is Less Expensive, Environment- Friendly, and Gives Better Productivity.
- Fodder Production Is another Important area. Contract Fodder Production in Farmers' Fields During the Time Between Wheat and Rice Cultivation and Making Silage Is the Best Option If Own Land Is Not available. Growing Hydroponic Green Fodder Can Be of Immense Help with Less available Space.
- After Establishing the Farm with the First Set of Purchased animals, a Good Breeding Program to Efficiently Manage and Expand the initial Herd of animals Is Essential for Productivity. artificial insemination Is a Tested Technique to Design a Breeding Program without Male animals. Many State Governments in India are Promoting artificial insemination (Ai) and Supplying Semen to Farmers at Nominal Cost. animal Health Workers and Veterinarians Can Help inseminate animals. to Procure the Best animal Through the Planned Breeding Program, one Can Opt for Imported Semen. Nowadays, Even Sexed Semen (Use of Sexed Semen Will Ensure only Female Calf) Is also available.
- Many Farmers Want to Start an organic Dairy Farm. Getting formal Certification for the organic Farm Is a Long Process and Needs investments. the Cost of Production of organic Certified Milk Is High and therefore It Is Necessary to Survey the Market to Understand the Price Premium for organic Milk in the Concerned area. organic Milk (Not Certified) Production Is always Encouraged But Everything Will Depend on Economics. (Price of Milk.) for organic Milk Production It Is Essential to Feed the Cattle with Feedstuffs and Fodders Which are Free of any Chemicals. Procurement of Such inputs Can Be Challenging.
- Nowadays, there are Indian Companies That Can Help Keep Scientific Farm-Level Data on a Web-Based Platform and Do the analysis of Such Data for Preventive and Management-Related actions. This Is Very Important as Prevention of Diseases in animals Is always Better Than Cure and Progress of the Farm Cannot Be Measured without Proper Data Recording. Such Service Providers Will Give Pre-Warning or alert SMS. one Can Upload

Data E.G. Milk Production Record, Breeding Record, Treatment Record, Etc. Through Mobile Phones and Receive Reports Via SMS.

- ‘Dairy Farming’ and ‘Milk Processing’ are Two Related But Different activities. Processing Is Possible Both in Small Scale (Traditional) and in ‘Medium to Large’ (With Equipment) Scale. Medium to Large Scale Milk Processing Is a High investment Business and one Needs to Either Produce a Large Quantity of Milk (Generally Min 3000 Lit Milk) or Procure Milk from Small Farmers. Milk Procurement, Processing, and Marketing of Products Is a Competitive Business activity and Requires Detailed Planning. in India Nowadays Very Large Companies Like ITC, Reliance, etc. are Now Entering into the Milk Processing Business, and in the Years to Come More Indian and foreign Companies are Likely to Come Up with Numerous Dairy Products.

2. ESTABLISHMENT OF DAIRY FARM

2.1. Preparatory Stage for Dairy Farm Establishment

Land/Site Selection for Dairy Farm

Status of Land/Site: Land for a Dairy Farming Usually Will Be available in a Rural Location and Has to Be Finalised at the Panchayat/Municipality Level. It Is Necessary to Check Whether the Particular area/Locality Has No Restrictions on Setting Up the Planned Type of Unit. Though Such Restrictions are Generally Meant for industries That Cause Pollution, It Is Better to Be Clear on the Land Usage Pattern Prior to the Planning Stage.

Land infrastructure: the Existing Physical Condition of the Land Should Be ascertained. as Most of the Rural Locations are Used for agricultural activities, the Ground Levels May Vary and one May Need to Determine Whether It Requires Landfilling to Match the Ground Level with the Neighbouring areas. Otherwise, Rainwater accumulation Problems May Occur. Water Bodies within the Parcel of Land Can Be Detrimental Because there are Strict Rules in Many Parts of the Country against Filling Up Water Bodies as This Will Reduce the actual Usage area and Have Commercial Implications. Clearance of Full-Grown Trees for Construction of the Dairy Facilities Which May Require Environmental Clearance Is another Critical area That Needs to Be Planned in advance.

Connectivity: a Vital Location with Surrounding infrastructure in Terms of Proper Roads, Vicinity to Highways and Straightforward accessibility Need to Be Considered. accessibility to Nearest Electricity Points and Water Resources are to Be Ensured Before the Selection of the Particular Land.

Transport: Transport Facilities and Options are Important Points to Be Considered Before Selecting a Business Location. availability of the Nearest Commercial Transport Hub for organising Milk Supplies and Facilities of Public Transport are to Be Considered. an Easy and Convenient Connection Is Essential Since a Large Number of associates Like Vendors, Technicians, Consultants and Even Customers Will Visit the Site.

Nature of the Neighbourhood: the Serenity of the Selected Site Should Be assessed in advance to Ensure a Peaceful Neighbourhood with Less Disturbances and Problems.

Budget: Cost of the Land Needs to Be Clarified Before the Finalisation Process. the Choice of Location Must Be in Line with the Provision in the Business Plan.

Key Elements to Consider for Land/Site Selection:

- Inherent advantages of the Location Like Proximity to a Large Colony or a township and Residential areas Nearby That Serve as a Potential Customer Base Should Be Considered.
- There May Be Other Factors to Be Considered for the Location Choice, Specific to the Requirements and the Piece of Land.
- The Final Decision Has to Be Taken after a Thorough Review of all the Issues.

Construction and Design of the Dairy Farm

Blueprint/Design of Farm

- Provides a Clear Plan for Establishing the Dairy Farm.

- Visualizes the Physical Structure Through Technical Drawings.
- Specifies Dimensions, Stock Rooms, Window and Door Placements.
- Aids in Budgeting Construction Costs for Efficiency.

Infrastructure/Construction (Cost-Effective):

Designing a Cow Shed, also Known as a Dairy Barn or Cow Barn, Is a Critical aspect of Dairy Farming and Structures That House Cattle are Vital to the Success of a Dairy Business. a Well-Designed Cow Shed Provides a Comfortable and Productive Environment for Dairy Cows While Facilitating Efficient Management Practices. It Is Essential That these Buildings are able to withstand Weather Events, Have Reasonable Maintenance Costs, and Contain Materials Resistant to an interior Environment That Can Be Rather aggressive. Buildings Need to Provide a Safe Environment for Employees and animals, Remain in Good Condition for their Functional Life, with Minimal Maintenance, and Last for Longer Duration.

Improving Existing Buildings, or Designing New ones to Best Standards, has a Lasting and Positive Impact on animal Health and Productivity. Consequently, This Has a Beneficial Effect

on Farm Viability and Economic Growth Through:

- Key messages**
- Good design will support good health and welfare to the financial benefit of the farm business.
 - Visit other farms to gather ideas about building design and fittings.
 - The target for most cattle buildings is to ensure a design that maximises ventilation potential on a still day, without exposing the livestock to elevated air speed when the wind is blowing.
 - The ability of the floor to cope with, contain and direct excess liquids towards competent drainage is a key design feature.
 - Roof slope and design should be influenced by the type of stock in the building and how exposed the site is.

- When designing a new building, or improving an old one, there is an absolute requirement to calculate the area of outlet required in a roof to allow heat and moisture from the livestock to escape by natural convection.
- The inlet area, ideally split evenly across the two sidewalls, is an absolute minimum of twice the outlet area, and better at four times the outlet area.
- Calf housing will usually benefit from some form of mechanical ventilation.
- The use of large volume or general purpose buildings for calves is not recommended.
- Buildings should be designed, constructed and maintained so that they can be effectively cleaned.

- Reduced Disease Cost with Improved animal Welfare and Performance.

- Improved Efficiency of Labour (Time) and inputs (Bedding, Feed Etc).

- Improved Sustainability and Competitiveness in the Market.

- Better and Safer Environment for Staff to Work.

Farmers Should insist That any New Livestock Building Is Designed Specifically for Livestock and Not as a General - Purpose Building, as these often Have an insufficient Ridge Opening to Ensure Effective Ventilation.

Environmental Considerations in Livestock Building Design:

There are Many Different Building Designs But in all Cases the accommodation Must Control Three Key Environmental Parameters:

- Air Speed
- Moisture
- Fresh air

Air Speed (Draughts): air Speed within a Building Is Critically Linked to animal Health and Welfare. air Movement Is Essential to Bring Fresh air into the Building and Remove Moisture, Heat, and Gases, although too Much air Movement Is Counter-Productive. Excessive air Speed at animal Height Causes Wind Chill and Should Be avoided, Particularly for Young animals. This Is Because the Speed of the air around an animal Reduces the insulation Properties of Its Hair Coat, increasing the Rate of Heat Loss from the Body. If Sustained or Excessive, there Will Be a Direct Negative Impact on Productivity and Immune Competence.

Moisture: Moisture Is Produced by all Livestock in their Breath, Urine, Faeces and Sweat. the aim of Good Building Design Is to Prevent any Build-Up of Moisture by Ensuring Competent Drainage and Manure Management, and Effective Ventilation That Works in all Weather Conditions.

Excess Moisture: Excess Moisture Will

- Increase the Risk of Bacteria and Virus Survival
- Increase the Risk of Dirty Water Transmitting infection.
- Increase the Requirement for Bedding
- Reduce ambient Temperatures, Damp Buildings Generally Feel Cold. However, in Warm or Hot Weather, Dampness Can Be Used Beneficially to Cool Down Livestock and Buildings.



Younger animals are more likely to suffer from cold temperatures due to their higher Lower Critical Temperature (LCT) than older animals

Fresh air: Fresh air Is a Primary Requirement for Maximising Health and Productivity. Fresh air Facilitates the Removal of Heat, Moisture, Dusts, Gases and Micro-Organisms from the Building. It also Has a Further Vital Role. Fresh air Is Very Effective at Killing Pathogens, Killing Many Bacteria and Viruses. a Crucial Design aim for Existing and New Buildings Is to Deliver Clean, Fresh air to as Many Parts of a Livestock Building as Possible, But to Do So without Exposing Stock to Excessive Wind Speed. a Lack of Fresh air Is Sometimes indicated by an increase in airborne ammonia Concentrations. Elevated ammonia Concentrations Come from the Mixing of Faeces and Urine. Poor Drainage and/or Damp Bedding Can also Contribute to the Problem. Temperature Is often Considered to Be a Key Environmental Factor Especially for Youngstock Less Than Four Weeks Old. increased air Speed or High Moisture Levels Combined with Cold Temperatures Can Have Negative Impacts.



Timber sidewall with ventilated cladding delivers clean fresh air into the building



Spaceboard with a simple additional inlet area allows fresh air to enter

Shed Design for Welfare Requirements: Welfare Is the Physical and Mental Well-Being of an animal and Can Be influenced by the Building in Which It Is Kept. Building Design, Construction and Maintenance Should all address the Five Freedoms That Define the ability of a System to Provide Good Welfare.

The Five Freedoms are:

- Freedom from Hunger and Thirst – Easy access to Fresh Water and a Healthy Diet.
- Freedom from Discomfort – Provision of an appropriate Environment That includes Shelter and a Comfortable Resting area.
- Freedom from Pain, injury, and Disease – Prevention or Rapid Diagnosis and Treatment.
- Freedom to Express Normal Behaviour – Provision of Sufficient Space, Facilities and Company of the animals' Own Kind.
- Freedom from Fear and Distress – assurance of Conditions and Treatment That avoid Suffering of the animals.

Good Design Will Support Good Health and Welfare to the Financial Benefit of the Farm Business. adequate Stocking Densities for Feeding, Drinking, Loafing or Lying Down Will all Impact on Positive Health and Performance. Surfaces and Materials That Provide Adequate Drainage, Control Wind Speed, Minimise Sharp Edges, Provide Non-Slip Floors, and are Easy to Clean, Will all Contribute. the Five Freedoms Can Be applied to assess Current and Planned Buildings to See Where Improvements Can Be Made.

Building Costs: Building Design Decisions are Frequently influenced by Cost Considerations. Long-Term investment in a Structure That Will Optimise animal Health and Performance Should Take Priority Over any Short-Term Cost Savings. It Will Usually appear to Be Cheaper to Self-Build Than Use a Building Contractor. However, It Is Essential to Budget a Realistic Cost for Family Labour/Staff Time and incidental Expenses and Consider the Time It Will Take to Complete. the Range of Potential Buildings for Cattle Is Large, and the Cost Is influenced by Location, Terrain, Design Specification, Build Quality and Builder. the Variable Costs for

Elements Such as Bedding, Labour, Slurry Handling, Feeding and Removing Feed Waste, all Have to Be Considered in the Costs. Below Table indicates the Capital Cost for Different Style of Housing System (Table 1)



This building is of modern design and has high standards of construction

Table 1: Relative Cost of Different Housing Systems

Housing system	Relative capital cost %
Slats with storage tanks	100
Slats with scrapers underneath	85
Cubicles with calf pens	80
Bedded court with outside walling	75
Bedded shell with open sides	60
Open corral with feed stance	20

Managing Straw Yards:

Straw Yards Should Have a Scraped Concrete Feed/Loafing Passage as Well as the Bedded Lying area. This Concrete Helps Promote Hoof Wear and Prevent the Cattle' Feet Becoming Overgrown. aim for a Passage Width of at Least 2m for animals Less Than a Year Old, Which Is Scraped Regularly. in the Yard That Houses Both Suckler Cows and Calves, the Scraped Passage Needs to Be at Least 3.5m Wide. This allows Cows to Feed Through the Barrier, While Other animals Can Move around Behind them. It Can Be Useful to Put in a Small Step (Max 0.3m High) Between the Feeding/Loafing area and the Straw Bedded area. This Helps Retain the Straw in the Lying area and Prevent Manure Flowing on to It. It also Provides a Solid Edge against Which to Scrape When Cleaning Out the Loafing area.

Design Limits:

In Buildings Wider Than 27m, It Becomes increasingly Difficult to Deliver Clean, Fresh air into the Centre. Correct Ventilation inlet and Outlet areas are Vital for Good animal Health and are More Important Than Building Height and Volume. High Volume Buildings Will Be More Exposed to Extreme Weather Conditions Than Those of Low Volume and are Generally Not Suitable for Housing Young Milk-Fed Calves.

A Roof with a Low Pitch ($<12^\circ$) Will Be Subject to Greater Solar Gain Than Roofs with a Higher Slope. Solar Gain Can Cause Wide Daily Variation of Temperatures within a Building in Winter and Can increase Temperatures towards Uncomfortable Levels During Summer.

2.2. Internal Shed Design

Floors

The Floor of a Livestock Building Is Subjected to Substantial Physical and Chemical forces. If a Floor Is Well Constructed and Maintained It Will Benefit the Business by Maximising animal Comfort. Surfaces Should Be Slip Resistant and Free of Edges or Fittings That May Cause injury.

Characteristics of a Good Floor are That It:

- Provides a Relatively Dry Walking Surface
- Provides Firm and Comfortable Footing
- Is Durable

The ability of the Floor to Cope with, Contain and Direct Excess Liquids towards Competent Drainage Is a Key Design Feature. Floor Slope, Floor Surface and Linkage to Drains are all Relevant to Cattle Comfort and Management of Moisture within the Building. a Slope of 1 in 20 Is Used Where Drainage Under Straw Is Needed, or around Drinkers. This Is a Particular Requirement around automatic Milk Feeders to Cope with the Expected Higher Urine Loads around the area.

Table: Ideal Floor Slopes for Different areas of the Building

Area of floor	Gradient	Angle
Passageways	1 in 80	1 to 2 degrees
Under straw – no drainage	Nil	0 degrees
Under straw – drainage areas	1 in 20	5 degrees

Concrete Floors

The Quality of the Floor Construction Is Important for Both Comfort and Durability. the Quality of the Concrete Mix and the amount of Water added are Essentially Linked to How Durable the Floor Will Be. Rough Finished Floors Can Speed Footwear by Up to 20%. Smooth Surfaces increase the Risk of Slippages and injuries, and are Especially Dangerous in High-Traffic areas or Where Cows/Heifers May Exhibit Bullying Behaviour. Cattle are Less Confident Moving Over Smooth Floors. Grooved Concrete Flooring Is Used Successfully in the Dairy Sector to Improve Cow Comfort and Drainage.

Basic Design Parameters for Creating a Grooved Floor That Provides Confident Footing are:

- Parallel Grooves Spaced 35mm apart.
- Grooved Edges That are Smooth.
- Lateral Grooves (That Go from Side to Side of a Cow) Produce Less Slip Than Longitudinal Grooves (That Run from Head to Tail).
- Groove Width Should Not Exceed 10mm

Slatted Floors

Slatted Floors are a Means of Removing the Need for Straw or Other Bedding Materials. the Faeces and Urine are Trodden Through the Slats into a Tank Below. Slats Can Be Covered with Rubber to increase Comfort.



Slatted floor without rubber matting



Grooved concrete flooring is used successfully in the dairy sector



Rubber slatted floor

Table: Dimensions of Slatted Floors for Cattle

Weight and type of animal	Preferred slat width (mm)	Slot width (mm)		Void ratio* %
		min	max	
Calves and youngstock up to 200kg	80	20	30	18–25
Beef animals and youngstock 200kg to 550kg	100	25	35	18–25
Adult cows and cattle over 550kg	125	30	40	18–25

* Void ratio is the percentage of the floor area that is open for faeces to get trodden through

Rubber Flooring

Rubber Flooring Is More Comfortable for Cattle Than Slats. This Is Because:

- There Is Less Mechanical force on their Feet When they are Standing.
- They are More Confident When Getting Up or Down
- There Is increased thermal Comfort When they are Lying Down

Cattle also Show Behavioural Preferences for Slats with Rubber Flooring Compared with Slats with No Rubber. Rubber Mats are Extensively Used in the Dairy Sector, Especially If the Cost of Traditional Bedding Materials Is High.

Cubicles:

Placing Cubicles in Buildings Is an Efficient Use of Space and Bedding, and Especially Suited to Housing Female Cattle. they are Not Suitable for Male Cattle Because they Urinate in the Centre of the Cubicle.

The Design Requirements for Cubicles:

- Allow at Least 5% More Cubicles Than animals in the Group to Reduce Bullying and increase Lying Times.
- Allow the animal to Lie Down and Stand Up without touching the Partitions.
- The Length Must accommodate the animal's Body Space, Headspace and Lunging Space (The forward Movement Cows Make When They Stand Up)
- Lunging Space of 0.7m to 1.0m Should Be Provided at the Front of the Cubicle.
- A Brisket Board in Front of the Cow Will Help Her to Get Up and Down.
- Cattle Prefer a Slight Fall of 2-3% from Front to Back of Cubicles, Which also aids Drainage.
- Cubicle Length Should Prevent Dunging on the Bed.
- Cubicle Widths Will Depend on Partition Design. Those with a Rear Leg Should Be 1.2m apart.
- Passage Widths Between Rows of Cubicles Should Be a Minimum of 3m Wide.
- Feed Passages Should Be at Least 4.6m Wide Behind Cubicles



Cubicles with rubber matting

Observation of Cow Lying Behaviour, Cubicle Hygiene and abrasions of Hocks and Knees, or Swelling in the Lower Leg, May indicate Poor Cubicle Design.

Table: Guidelines on Cubicle Length Depending on the Size of Cow

Weight of cow (kg)	Total length of bed (m)		
	Open front	Closed front	Head to head
550	2.10	2.40	4.2
700	2.30	2.55	4.6
800	2.40	2.70	4.8

Lighting

For Efficient and Safe Working, It Is Sensible to Provide adequate Lighting That Is Evenly Dispersed Throughout the Building and Can Be Controlled. Light intensity Is Measured in Units of Lux.

A Daily Period of Darkness (Less Than 30 Lux) Is Essential to Maintain Hormone Balance in Cattle. Long Day Lengths of 16–18 Hours of Light at +170 Lux, interspersed with Six to Eight Hours of Dark, Have Been Shown to increase Liveweight Gain, advance onset of Puberty in Heifers, and increase Milk Yield in Cows.

**Table: Lighting Requirements for Different Tasks and Locations within the Shed**

Task or location	Lux level required	Control	Comments
Lying and feeding area (a)	170-200 lux for photoperiod effect	Timed, with light level sensing	High pressure sodium, metal halide lights or multiple fluorescent fittings
Lying and feeding area (b)	50 lux for general use	Timed with manual override	
General	50 lux	Timed with manual override	
Inspection	300 lux		Local or portable light
Outside areas	20 lux	Timed, with option of passive infrared (PIR) movement sensors	High pressure sodium, metal halide lights

2.3 External Shed Design

The Roof: Roof Slope and Design Should Be influenced by the Type of Stock in the Building and How Exposed the Site Is. a Roof Slope of 17° to 22° Will Ventilate Better Than one of Between 7° and 10°. once the Slope of the Roof Is Set, the Ventilation Outlets Can Be Chosen – Commonly Either an Open or Covered Open Ridge, or Slotted Roof.

Many Livestock Buildings in the UK are Roofed with Fibre Cement Profiled Sheetings. This Is a Preferred Material as It Is Durable, Has Limited absorbency of Condensation, and Produces a More Stable internal Temperature Than Steel Roof Sheetings, often Referred to as ‘Tin’.

Tin Is the Least appropriate Material for animal House Roofing Because It increases the Risk of Condensation Compared with Most Other Roofing Materials. Condensation Is Moisture That Would Have Left the Building If the Ventilation Specification and the Roof Materials Were More appropriate.

A Number of New Roof Sheets are available That Use a Self-Adhesive Polyester Fleece Designed to Be applied to Single-Skin Metal Roof Panels. they Provide Enough insulation to Reduce the Rate of Condensation, and Reduce the amount of Moisture Dripping onto Bedding.

Rooflights: Translucent Single Skin Rooflights are a Good Source of Natural Light within a Shed. Requirement Is for 10–15% of the total Roof area to Be Rooflight, Possibly Up to 20% on the North-Facing Side of a Roof, or on the Roof of Calf Housing.



Slotted roof made of fibre cement profiled sheeting



The addition of a light ridge will improve ventilation and increase the amount of natural lighting

Roof Refurbishment: Clean or Replace Faded Rooflights to Improve the Environment within a Shed. Traditional Steel or Concrete Livestock Buildings with a Few Roof Lights and Poor Ventilation Can Be Completely Rejuvenated by installing a Light Ridge.

Sidewalls: Many Calf and Cattle Buildings Require Side Wall Cladding That Is Solid to animal Height, with Some form of air inlet above animal Height. the Requirements are to:

- Reduce Wind Speed at animal Height
- Provide adequate Openings to Supply Fresh air into the Building

Buildings Where Feeding Occurs along an Outside Wall Should Be Protected to above animal Height with an External Bund or Windbreak, to Moderate the Negative Impact of Windchill on animal Health and Performance.

The Conflict Between Reducing Wind Speed into a Building to Prevent Wind Chill, Whilst allowing adequate Fresh air to Maintain a Healthy Environment, Is a Crucial Part of Building Design. Getting This Balance Wrong often Leads to Poor Health and Performance in Housed Cattle.

A Small available area of Sidewall Will Need a Large Number of Openings Compared with a Large area of Sidewall, to achieve the Same inlet area. the Design Trick Is to Provide the Required area of Openings without Losing Control of air Speed into the Building.

Protection from Windspeed: the Horticulture industry Has Long Understood the Effects of Excessive Wind Speeds and Uses Windbreaks to Protect Crops and Reduce the Costs of Production. for Cattle, the Impact of Wind Speed on them Can Vary from Very Little, Through to Reduced Feed Conversion and Immunity Suppression, to Severe Disease.

Draughts Hitting animals Causes them to Lose Heat Energy. Energy Loss Will Double When Wind Speed Rises from 0 to 6.8m/S (15mph).

Basic Rules for Using Windbreaks:

- The Purpose Is to Reduce air Speed, Not to Stop It.
- A Badly Located or Poorly Finished Windbreak Is often Worse Than No Windbreak.
- The Optimum Porosity/Permeability of a Windbreak Is 50%.
- the Minimum Ratio of Length to Height of a Windbreak Is 12:1. This Will Minimise the Effect of the increased Wind Speed Coming around the Ends of the Windbreak.
- Wind Speed Will Be Reduced Downwind of a Permeable Windbreak by Up to 30 Times the Barrier Height. Support Structures for Windbreaks Should Be at approximately 3m intervals.



A ventilated roller blind offers protection against draughts

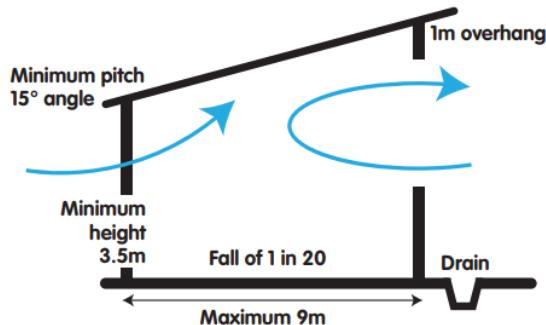
Mono-Pitched Buildings-Guidelines

- The Floor Should Slope from Back to Front with a Drain Outside the Pens to avoid Cross Contamination Between Pens.
- If Housing Calves, Ensure the Gates to the Front, or an internal Division Provides Full Protection against Draughts at Calf Height. Consider Provision of an internal Kennel for Milk-Fed Calves During Winter Months.
- A Building with a Sloping Roof Should Not Exceed 9m in Depth. If the Building Needs to Be Larger a Pitched Roof Is Required
- There Should Be a Minimum Height of 3.5m from Floor to Roof at the Lowest Point
- The Roof Should Have a Minimum 15° Pitch. Below This Pitch airflow Is Poor in Most Wind Directions. a Steep Pitched Roof Over 22° Has the Ideal airflow Pattern

- Buildings Should Face the Sun, So That Sun Can Enter the Pens, Ideally with the Back against the Prevailing Wind



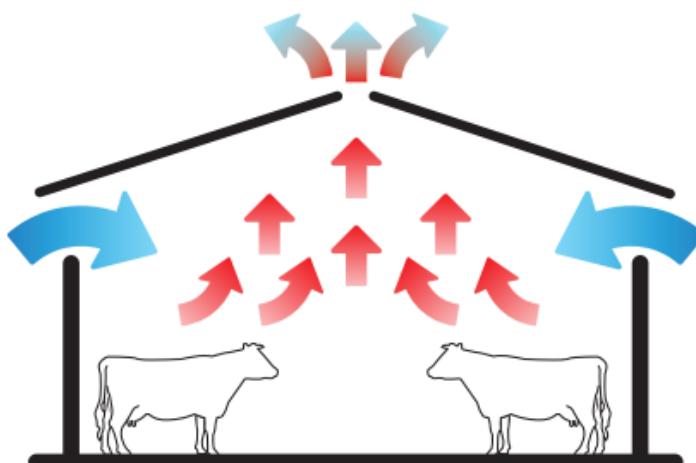
A mono-pitched building



Ventilation

The Target for Most Cattle Buildings Is to Ensure a Design That Maximises Ventilation Potential on a Still Day, without Exposing the Livestock to Elevated air Speed When the Wind Is Blowing. This Is Possible for Many, But Not all Buildings, and Usually Relies on Ventilation Via the Stack Effect.

Heat Generated by the Livestock in the Building Warms the air Which Rises, to Be Replaced by Fresh air Coming in at a Lower Level Through the Eaves. Lack of air Movement Can Be Tested on a Still Day by Using Smoke Pellets to Track air Movement.



Use the animals' expected maximum weight when calculating ventilation requirements.

Figure: the Stack Effect inside a Naturally Ventilated Building

Ventilation Calculations

When Designing a New Building or Improving an Old one, It Is Critical to Calculate the area of Outlet Required in a Roof to allow Heat and Moisture from the Livestock to Escape by Natural Convection. the inlet area Required in the Side Walls to Support the Natural Ventilation Can Be Set once the Outlet area Has Been Calculated.

Outlet Design:

The Outlet area Is Best Provided by a Narrow Opening along the Length of the Ridge, 150mm to 350mm Wide Depending on Stocking and Building Design. the Wider the Opening the More Likely



A slotted roof is good where animals are housed all year



A covered open ridge

Rainwater Is to Come in. in This Case a Covered Open Ridge Is appropriate. a Ridge Like This Should also Be Used above Cubicles or anywhere Rainwater Entry Could Be a Problem. an Open Ridge Is Usually Between 200–350mm Wide and Should Be Unrestricted.

The Light Ridge or Similar Design Is a Useful Ridge as It Provides adequate Outlet area and additional Natural Light within a Building. It Is Particularly Useful for Improving Existing Buildings Where the Two Sets of Purlins Supporting an Existing Enclosed Ridge are Widely Spaced (>700mm apart) and Fixing a 200–300mm Open Ridge Would Normally Be Difficult.

Slatted Roofs, Where Roof Sheets are inverted and Fitted with a Space of 10-20mm Between Each adjacent Side Sheet, Can Be Very Useful, Particularly Where Housing all Year, or on Lean-To Roofs with a Low Pitch. they are Not Suitable for Youngstock <150kg. However, they Do Reduce the Flexibility of the Use of the Building for Non-Livestock Uses. Trimmed Sheets Specifically for Slotted Roofs are available.

Figure: an Open Ridge

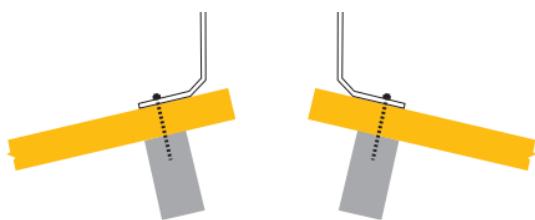
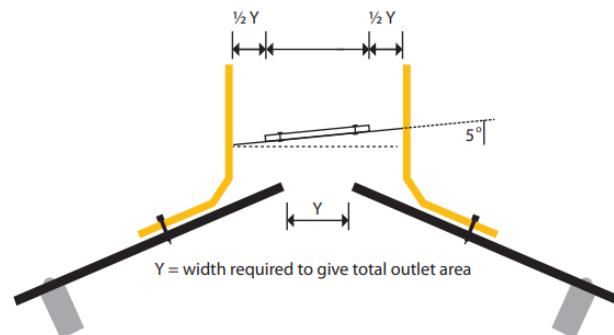


Figure: a Covered Open Ridge



Cranked Ridges are Not Suitable as they only offer around 20% of the Required Outlet, although they are Still Commonly Fitted.

Inlet Design: the aim of the inlets Is Not to Restrict airflow But to Reduce airspeed at animal Height. the aim Should Be, Where Possible, to Ventilate the Building from the Sides. inlets areas in the Gable Ends are only Recommended Where the Building Is Excessively Wide (>25m), or Where there are Restrictions in the inlet areas along one or Both Sides of the

Building. a Cladding Material with Many Small Openings Is Suitable for inlets in the UK for Winter Housing. the Design Requirement Is to Match the available Materials with:

- The Calculated Optimum area of inlet for Each Sidewall.
- The available area in the Sidewall for Cladding.
- The Degree of Exposure to the Weather of the Sidewall. the inlet area Can Be Greater Than the Calculated Opening as Long as Due Consideration Is Given to air Speed at animal Height.

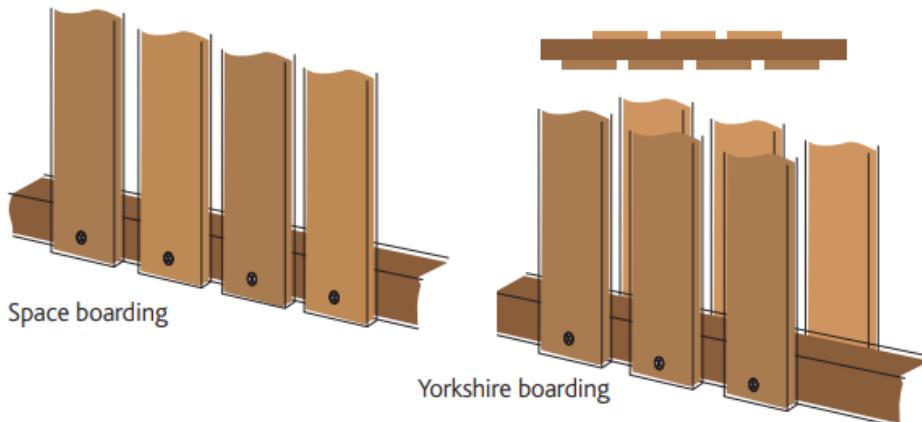


Perforated wall cladding

the Required inlet area for the Example Building Could Be Covered with:

- A Horizontal Slot 410mm Deep, Below the Eaves, the Full Length of the Building.
- Space Board (100mm Board, 25mm Gap) the Full Length of the Building.
- Yorkshire Boarding (152mm Board, 38mm Gap) the Full Length of the Building.
- Plastic or Woven Cladding with at Least 20% Void.
- Perforated Metal Sheeting with at Least 20% Void.

A Horizontal Slot inlet Needs to Be Further Protected from Wind Penetration, for Example with Overhanging Eaves. Space Boarding Should Not Be Used with a Gap Larger Than 25mm, Otherwise Wind, Rain and Snow Will Penetrate the Cladding.



Mechanical Ventilation

There are a Number of Situations Where Mechanical Ventilation Is Valuable. often the Layout and Development of Farm Buildings Leaves areas That Just Cannot Be Naturally Ventilated – Known as ‘Dead Spots’. these areas Can Be Significantly Improved by Either Blowing air into the Space (Positive Pressure Ventilation) or Sucking air Out (Negative Pressure Ventilation). in Either Case It Is Still Essential to Provide adequate inlet and Outlet areas.

Positive Pressure Ventilation Is the Most Common Mechanical Ventilation System Used in Cattle Buildings. in Effect It Provides an additional inlet to a Livestock Building. the Fan Should Be Used with an air Straightener and a Duct So That Fresh air Can Be Distributed along the Full Length of the Duct. Typical Systems Support Ducts Up to 30m Long.

Negative Pressure Ventilation Is Less Common, But Can Be Well Suited to Low Volume areas Such as Small Calf Houses, Buildings with Low Roof Heights, and Old Traditional Buildings with Roofing That Is Difficult to Change.

The areas of inlet are Particularly Important in Negative Pressure Ventilation Systems as the Fans Will always Draw air from the Easiest Source, Which May Not Be of Benefit at animal Height.

Calf Housing Will Usually always Benefit from Some form of Mechanical Ventilation. This Is Due to the absence of Heat Produced by adult Cattle within the Building Space. Young Calves Will Not Be able to Generate Sufficient Heat to Drive the Stack Effect.

It Is Good Practice to Have inlets of an appropriate Size to Match the Performance of the Chosen Fan. the aim Is to Have an inlet area That Does Not Restrict air Flow Rates, and Does Not Create an air Speed (Vmax) of More Than 2.5m/S at the inlet (To Prevent Chilling).

Dead Spots

Dead Spots Can Be Readily Identified by Using Smoke Tests to Visualise the Movement of air in a Building. Ideally Smoke Should Rise towards the Ridge and Be Cleared from the Building in 45-60 Seconds. Suitable Smoke Pellets Can Be Purchased from Plumbing Suppliers.

Traditional Buildings with a Loft above a Livestock area Can Sometimes Be Improved by Removing one or Two Boards in the Loft Floor and Covering the Subsequent Holes with Weld Mesh. alternatively, a Chimney Can Be added from the Loft Floor to the Outside, or a Negative Pressure Fan Placed in the Loft Floor to Extract Stale air.

Chimneys

Simple Chimneys are Widely Used in the Pig and Poultry industry for Ventilation. the Main Potential for the Cattle Sector Is in Buildings Where the Roof Ridge Cannot Be Opened Up, or Where the Roof abuts the Wall of an adjacent Building. the Requirement Is to Have an Outlet in the Roof Below Ridge Height That Does Not Let in Water. If a Slotted Roof Is Not Suitable, a Chimney Can Be Fitted Retrospectively. Products are available with a Combined Roof Plate That Fits the Profile of Most Standard Roof Sheets.

Feeding and Watering System

the aim of the Feeding System Is to:

- Keep Clean Feed in Front of the Cattle and within Reach.
- Incur the Minimum amount of Labour to Push Feed Up and Clean Old Feed Out.
- Minimise Bullying



A feed trough designed to keep feed in front of cattle at all times

Feed and Barrier Design:

The Specific Dimensions and Design of the Feed Barriers Will Depend on Cattle Size, Group Size, Feed Type and Labour availability. Ideally, they Should Be Flexible to accommodate a Range of Cattle Types and Sizes. Width of the Feed Barrier Depends on the Size of the animal, the Method of Feeding and Degree of Competition Between Cattle. an Open Horizontal Barrier increases the Risk of Dominant Cattle Poaching Feed from Others. Diagonal Barriers Reduce the Risk of Bullying, and Both tombstone and Dovetail Barriers Provide a Discrete Feeding Space for individual animals. Feed Wastage Can Be increased and Feeding Times Reduced If animals Can Be Easily Disturbed Whilst at the Feed Fence. It Is Useful If the top Brisket Board or top Rail Can Be adjusted to Suit Cattle of Different ages.



Diagonal feed barriers



Feed barriers with locking yokes

The Key Requirements for Feeding areas are:

- The Bottom of the Feed Trough Should Be No More Than 100mm above animal Foot Level and Be Smooth to Encourage Feeding and Make Cleaning Easier.
- Trough or Brisket Board Should Be around 500mm High for adult Cattle, with a Smooth Finish.
- The Neck Rail Height Should Ideally Be adjustable from 1150–1250 Mm above Floor Level for adult Cattle (900–1100mm for Younger Cattle). the Neck Rail Should Be High Enough So That an animal's Neck Should Rarely touch It.

- The Maximum Reach of Cattle Varies with age, But Can Be Up to 1.0m for adult Cattle. Reach Can Be Improved by Fixing Feed Rails and Diagonal Barriers at a Slight forward angle (About 20°).

Look Out for Tell-Tale Signs of Feed Barriers That Need adjusting, Such as Hair Being Rubbed off the Back of the Cattle's Neck. an animal's Neck Should Not touch the top Rail While Feeding.

Water Troughs

Provision of Clean Drinking Water Is a Primary Requirement of all animal Housing and It Must Be available at all Times. the Location of Drinkers Must Not Restrict Lower-Order Cattle from Drinking. Water Is Frequently Spilt at and around Water Feeders. It Is therefore Sensible to Locate Drinkers above an area That Drains Freely, So as Not Cause a Build-Up of Moisture Either in Bedding, or by Creating an increased area of Damp Floor.

Tipping Troughs, or Troughs with Large Emptying Valves That Can Be Emptied onto Crossover Passages, Help Keep the Water and Floors Clean. However, Water Must Be able to Drain away Effectively. Water Consumption by Cattle Varies Widely according to Factors Such as Live Weight of the animal, ambient Temperature, Milk Yield and Ration Moisture Content.

Research Has Shown That Milk-Fed Calves Will Take Between 0.75 Litres and 2.0 Litres of Fresh Water Per Day. It Is Recommended That adequate Water Trough Space or Water Bowls Must Be Provided to allow at Least 10% of the Group to Drink at any one Time. these Should Be Located at the Correct Height for the animals, Which Can Be a Challenge with Rapidly Growing animals.



Easy access *ad-lib* water



Drinkers located outside pen

Water Harvesting System: Rainwater Harvesting (Rwh) Is the Collection and Use of Rainwater Falling onto Buildings Which Would Otherwise Have Gone Down the Drains, Been Lost Through Evaporation, or Soaked into the Ground. Such Systems Can Be Fitted to New or Existing Buildings and Range in their Complexity. they offer a Means of Reducing Water Costs.

2.4 Types of Dairy animal Housing

The Most Widely Prevalent Practice in Our Country Is to Tie the Cows with Rope on a Mud Floor Except Some organized Dairy Farms Belonging to Government, Co-Operatives or Military Where Proper Housing Facilities Exist. It Is Quite Easy to Understand That Unless

Cattle are Provided with Good Housing Facilities, the animals Will Move too Far in or Out of the Standing Space, Defecating all Round and Even Causing Trampling and Wasting of Feed by Stepping into the Mangers. the animals Will Be Exposed to Extreme Weather Conditions Leading to Poor Health and Lower Production. Dairy Cattle May Be Successfully Housed Under a Wide Variety of Conditions, Ranging from Close Confinement to Little Restrictions Except at Milking Time. However, Two Types of Dairy Barns are in General Use at the Present Time.

- The Loose Housing Barn in Combination with Some Type of Milking Barn or Parlor.
- The Conventional Dairy Barn.

2.4.1 Features of Loose Housing System

1. Layout:

- Includes an Open area and a Resting area.
- Animals are Kept Loose in Groups During Both Day and Night, Except for Specific activities Like Milking, Treatment, and Breeding.

2. Shelter Features:

- Covered Shed Provides Protection from Extreme Weather Conditions.
- Common Manger for Feed and Fodder, Common Water Troughs for Water.
- Compound Wall or Fencing of at Least 5 Feet Height for total area Protection.
- Separate Milking Parlour with Facilities.

3. Ideal for: areas with Low Rainfall.

4. Flooring:

- Should Be Waterproof, Easily Cleanable, and Non-Slippery.
- Materials Like Bricks or Grooved Cement Concrete Can Be Used.

5. Consequences of insufficient Space:

- Overcrowding Leads to abnormal Behavior, Decreased Body Weight Gain, and Overall Performance Drop.

6. Floor Space Requirements:

- Variations for Different Categories of animals, as Shown in a Table.

7. Mangers and Water Troughs: Location:

- Water Troughs Near Feeding area, Seldom in Resting area.
- Ensure Free access to Feed and Water Round the Clock.
- Constructed with Reinforced Cement Concrete, Brick with Cement Mortar, or Stone Slabs with Cement Joining.
- Mangers Should Have Smooth Surfaces for Easy Cleaning and Feed intake.
- Water Depth Minimum 3 inches, allowing animals to Submerge Muzzle 1 to 2 inches.
- Separate Watering Point for Every 15 to 20 Cows.
- Young Calves Not Given Water When Milk or Milk Replacer Fed, to avoid interference with Digestion.

8. Resting area

- The Resting area Should Be a Building or Enclosure Where Cattle Can Rest or Lie Down on a Dry Bed.
- It Should Provide Shelter from Cold Winds, Snow, Rain and Extremes of Weather, and Should always Be Roofed.

- The Resting area Should Not Be Used as a Waiting or Exit area for the Milking Parlour. Feeding and Watering Is Never Provided in the Resting area.

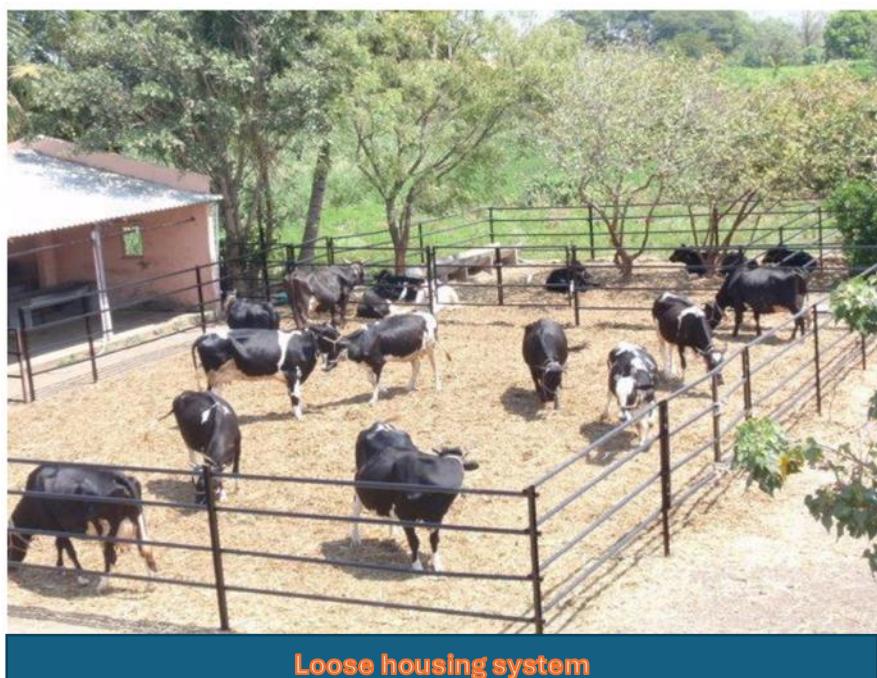
9. Bedding Material for Resting area

- Bedding Should Be Provided to the animals to Keep them Clean and Comfortable.
- It Should absorb any Liquid Manure. the Desirable Qualities of the Bedding Material are Bulkiness and Large Liquid absorption Capacity. the Usual Bedding Material are Wheat Straw, Rice Straw and Sawdust.
- Cemented Floors are Usually Preferred, However, Earthen Floors Could Be Considered for Resting areas, Provided they are 8 to 12 inches above the Ground Level and Sloped away from the Building to Provide Good Drainage.

Advantages of Loose Housing System

The Loose Housing System involves:

- Low Cost of Construction and Maintenance,
- Provides More Comfort to animals,
- Ensures Easier Detection of Oestrus and Better Labour Efficiency, as Compared to the Conventional Housing System.



2.4.2 Conventional Housing System

In Conventional Housing System,

- The animals are Tied in a Stall for Feeding, Watering, Milking and Resting.
- They are Confined together within the Shed and Tied by Neck Chains.
- The Barns are Completely Roofed, and the Walls Have Windows and Ventilators.
- The Distance Between Two Sheds Is Generally Not Less Than 30 Feet.
- The Feed Is Delivered in a Trough in Front of the animals, and
- They are Milked individually in the Stall Using Buckets.

- The Manure Is Collected in a Gutter.
- The Conventional Barns Provide Better Protection When Winter Is Prolonged and Severe, and Is Most Suited for Temperate Regions, as It Protects the animals from Heavy Snowfall, Rains and Strong Winds.

Disadvantages of Conventional Housing System

- If the Cattle are Tied Up all Year Round, their Feet Become Stiff and Could Lead to Feet Problems.
- Oestrus in Cattle Is Difficult to Detect.

Advantages of Tail to Tail System

Under the average Conditions, 125 to 150 Man Hours of Labour are Required Per Cow Per Year. Study of Time: Time Motion Studies in Dairies Showed That 40% of the Expended Time Is Spent in Front of the Cow, and 25% in Other Parts of the Barn and the Milk House, and 60% of the Time Is Spent Behind the Cows. Time Spent at the Back of the Cows Is 4 Times More Than the Time Spent in Front of them.

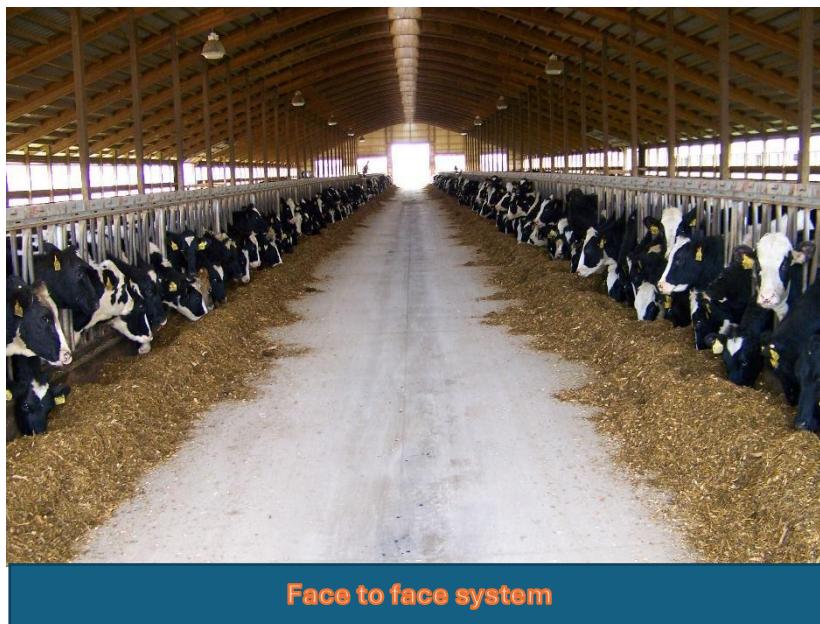


- In Cleaning and Milking the Cows, the Wide Middle alley Is of Great advantage.
- Lesser Danger of Spread of Diseases from animal to animal.
- Cows Can always Get More Fresh air from Outside.
- The Head Gowala Can inspect a Greater Number of Milkmen While Milking. This Is Possible Because Milkmen Will Be Milking on Both Sides of the Gowala.
- Any Sort of Minor Disease or any Change in the Hind Quarters of the animals Can Be Detected Quickly and Even automatically.

Advantages of Face to Face System

- Cows Make a Better Showing for Visitors When Heads are together
- The Cows Feel Easier to Get into their Stalls.
- Sun Rays Shine in the Gutter Where they are Needed Most.

- Feeding of Cows Is Easier, Both Rows Can Be Fed without Back Tracking.
- It Is Better for Narrow Barns.



2.5 animal Shed Components

2.5.1 Milch animal Shed

The Length and Width of the Floor area of the Milch animal Shed Is Calculated Based on the average Size of animals. the Per animal Floor Space Requirement May Vary from 1.5 to 1.7 Metres in Length and 1 to L.2 Metres in Width. the Width of the Central Passage May Be 1.8 Metres. the Central Passage Should Have a Slope in Such a Way That the Central axis Is 25 Mm Height and It Gradually Reduces to 1 Mm towards Both the Sides. there Should Be Two Drains Laid on Either Side of the Central Passage in Tail- to-Tail System. there Should Be Two Continuous Mangers on the Outer Side of the area. the Floor Has the Slope Ratio of 1 in 40 towards the Drainage.

2.5.2 Milking Parlour

The Cattle are to Be Milked in the Milking Parlour Which Is a Separate Structure in the Dairy Farm. the Milking Parlour Is a Must When the animals are Maintained in Loose Housing System. animals are Brought to the Milking Parlour for Milking and after That, they are Taken Back to the Feeding or Resting area. the Milking Parlour Is Usually a Part of a Larger Complex Known as the Milking Centre, Which Houses Supporting Structures and Equipment for the Parlour. a Milking Centre Consists of the Following.

2.5.3 Holding area

A Paved area Is Provided Just Outside the Milking Parlour Entrance to Hold the Cattle Till they are to Be Milked. It May Be Open or Covered area. the Space Requirement for the Holding area Is about 15 Square Feet Per animal. the Slope of the Holding area Is Opposite to the Entrance of the Milking Parlour.

2.5.4 Milk Room

the Room Is Used for Storing Milk and Equipment Meant for Cooling, Cleaning and Sanitizing the Milk.

2.5.5 Utility Room: in This Room, Equipment Such as Vacuum Pumps, Refrigeration Compressors and Water Heaters are Kept.

Double Rows of Standing Can Be arranged Either in Tail- to-Tail or Head-To-Head System. for the Purpose of Milking, the Tail-To-Tail arrangement Is Comparatively Better Than the Head-To-Head System. the Milking Parlour Can Be Used for Milking in Two–Three



Shifts Depending Upon the System of Milking (Hand Milking or Machine Milking).

Therefore, the Size of the Milking Parlour Is Such That It Can accommodate Half to one-Third of the total Number of Milking animals at a Time.

Type of Animal	Floor space per animal (Sq. feet)		Manger length per animal (inches)
	Covered Area	Open Area	
Cows	20 – 30	80 – 100	20-24
Buffaloes	25-35	80-100	24 -30
Young stock	15-20	50-60	15 -20
Pregnant Cows	100-120	180 – 200	24 -30
Bulls Pen	120-140	200-250	24 -30

Dimensions of Milking Palour	
Length of standing space	1.5 –1.7 metres
Width of standing space	1.05–1.2 metres
Width of central passage	1.5–1.8 metres
Width of feed alley	0.75 metre
Width of gutter	0.30 metre
Width of manger	1.40 metres

2.5.6 alleys: the Central Walk Should Have a Width of 5'-6' Exclusive of Gutters When Cows Face Out, and 4'-5' When they Face in. the Feed alley, in Case of a Face Out System Should Be 4' Wide, and the Central Walk Should Show a Slope of 1" from the Centre towards the Two Gutters Running Parallel to Each Other, Thus forming a Crown at the Centre.



Walking alley



Manure gutter

2.5.7 Manure Gutter: the Manure Gutter Should Be Wide Enough to Hold all Dung without Getting Blocked and Be Easy to Clean. Suitable Dimensions are 2" Width with a Cross-Fall of 1" away from Standing. the Gutter Should Have a Gradient of 1" for Every 10' Length. This Will Permit a Free Flow of Liquid Excreta.

2.5.8 Doors: the Doors of a Single Range Cowshed Should Be 5" Wide with a Height of 7', and for Double Row Shed the Width Should Not Be Less Than 8" to 9'. all Doors of the Barn Should Lie Flat against the External Wall When Fully Open.

2.5.9 Calving Boxes: allowing Cows to Calve in the Milking Cowshed Is Highly Undesirable and Objectionable. It Leads to Insanitation in Milk Production and Spread of Disease Like Contagious abortion in the Herd. Special accommodation in the form of Loose-Boxes Enclosed from all Sides with a Door Should Be Furnished to all Parturient Cows. It Should Have an area of about 100 to 150 Sq.Ft. with ample Soft Bedding, It Should Be Provided with Sufficient Ventilation Through Windows and Ridge Vent.

2.5.10 Isolation Boxes: animals Suffering from infectious Disease Must Be Segregated Soon from the Rest of the Herd. Loose Boxes of about 150 Sq. Feet. are Very Suitable for This Purpose. they Sh9uld Be Situated at Some Distance from the Other Barns. Every Isolation Box Should Be Self-Contained and Should Have Separate Connection to the Drainage Disposal System.



Calving shed

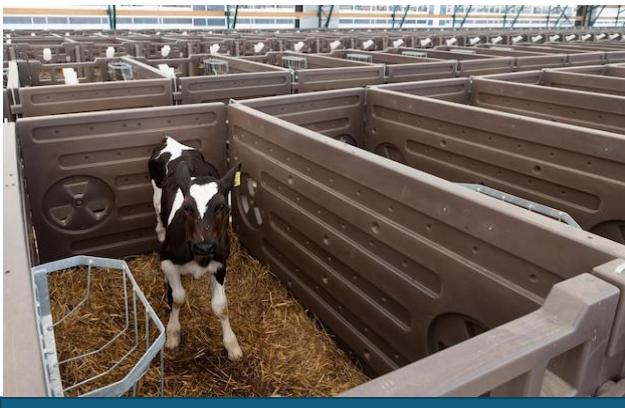


Isolatikon box

2.5.11 Sheds for Young Stocks

- Calves Should Never Be accommodated with adults in the Cow Shed.
- The Calf House Must Have Provision for Daylight Ventilation and Proper Drainage.
- Damp and Ill-Drained Floors Cause Respiratory Trouble in Calves to Which they are Susceptible.
- For an Efficient Management and Housing, the Young Stock Should Be Divided into Three Groups, Viz., Young Calves aged Up to one Year, Bull Calves, Female Calves.
- Each Group Should Be Sheltered in a Separate Calf House or Calf Shed.
- As Far as Possible the Shed for the Young Calves Should Be Quite Close to the Cow Shed.
- Each Calf Shed Should Have an Open Paddock or Exercise Yard.
- An area of 100 Square Feet Per Head for a Stock of 10 Calves and an increase of 50 Square Feet for Every additional Calf Will Make a Good Paddock.
- It Is Useful to Classify the Calves Below one Year into Three age Groups, Viz., and Calves Below the age of 3 Months, 3-6 Months Old Calves and Those Over 6 Months for a Better allocation of the Resting area.

- An Overall Covered Space of:
20-25 Square Feet Per Calf Below the age of 3 Months,
25 -30 Square Feet Per Calf from the age of 3-6 Months,
30-40 Square Feet Per Calf from the age of 6-12 Months and Over, and
- 40-45 Square Feet for Every Calf above one Year, Should Be Made available for Sheltering in adverse Climatic Conditions. a Suitable interior Lay-Out of a Calf Shed Will Be to arrange the Standing Space along Each Side of a 4 Feet Wide Central Passage Having a Shallow Gutter along Its Length on Both Sides. Provision of Water Troughs inside Each Calf Shed and Exercise Yard Should Never Be Neglected.



2.5.12 Bull or Bullock Shed

- Safety and Ease in Handling, a Comfortable Shed Protection from Weather and a Provision for Exercise are the Key Points While Planning accommodation for Bulls or Bullocks.
- A Bull Should Never Be Kept in Confinement Particularly on Hard Floors.
- Such a Confinement without adequate Exercise Leads to Overgrowth of the Hoofs Creating Difficulty in Mounting and Loss in the Breeding Power of the Bull.
- A Loose Box with Rough Cement Concrete Floor about 15' by 10' in Dimensions Having an adequate arrangement of Light and Ventilation and an Entrance 4' in Width and 7' in Height Will Make a Comfortable Housing for a Bull.
- The Shed Should Have a Manger and a Water Trough.
- If Possible, the arrangement Should Be Such That Water and Feed Can Be Served without actually Entering the Bull House.
- The Bull Should Have a Free access to an Exercise Yard Provided with a Strong Fence or a Boundary Wall of about 2' in Height, I.E., too High for the Bull to Jump Over.
- From the Bull Yard, the Bull Should Be able to View the Other animals of the Herd So That It Does Not Feel Isolated.
- The Exercise Yard Should also Communicate with a Service Crate Via a Swing Gate Which Saves the Use of an attendant to Bring the Bull to the Service Crate.

2.5.13 Dry animal Shed

The Shed for Dry animals May Be Loose Housing Type and Consist of Centrally Placed Manger Under a Roof in the Paddock. the Manger Is Surrounded by a 2.2-Meter-Wide Paved Platform with Drainage.

2.5.14 ancillary Structures

The Secondary Structures Which are Useful for Day-To- Day Farm Operations are Called ancillary Structures, and these are Useful for Both Loose and Conventional Systems of animal Housing. the Size and Number of Different ancillary Structures Depends on the Herd Size. the Various ancillary Structures are Described Below.

2.5.15 artificial insemination (Ai) Laboratory

Adjacent to a Bull Shed, there Is a 10 X 10 Metre Service Yard with a Service Crate for the Collection of Semen. the ai Laboratory Is attached to the Service Yard Where Testing, Processing and Storage of Semen Is Carried Out. the Minimum Dimensions for Laboratory are 3×4 Metres. an area of 3×4 Metre Each Is Required for Wash-Up Room and Room for Supervising Staff.

2.5.16 Trevis

Trevis Is Used for the Purposes of Both Treatment and artificial insemination of Cattle. It Is a U-Shaped Structure Made of 2 inches Diameter Galvanized Steel Pipes Supported by Five or Seven Pillars. one Horizontal Pipe Is Welded on the Sides across the Two Rear Pillars to Protect the Working Technician from Sidekicks by the animal. one adjustable Pipe Is Put across the Last Two Pillars Through the Clamps Fixed on Both Sides of these Pillars to Prevent the animals from Going Back Out of the Trevis. one Iron Ring for Tying the animal Is Provided at the top of Front Pillar to Prevent the animal from Jumping off.



2.5.17 Casting Pit

Trevis

It Is the area Where animals are forced to Lie Down for Treatment or Other Purposes. in Large Farms, It Is Desirable and Economical to Construct one Casting Pit That Can Be Used for Vaccination and Treatment of animals. the Dimension of the Casting Pit Is Usually 0.31 M Deep and 2.4 M High along with a Diameter of 7.62 M. the Casting Pit Contains about 15 Cm of Sand or Saw Dust or a Mixture of Both, Which acts as a Comfortable Bedding Material for the animals.

2.5.18 Sick animals Shed and Veterinary Dispensary

The Shed for Sick animals Is to Be Located away from the Healthy animal Sheds. Each Sick animal Is accommodated in a Single Pen within the Sick animal Shed. the Dimensions and arrangements of Sick animal Pens are the Same as for Calving Pens. the Paddock of the Sick animals Is Paved and Regularly Washed. a Trevis Is Placed at one of the Corners of the Paddock. for the Treatment of Sick animals, a Room of 3×4 Metres Is Provided with a Dispensing Counter, Shelves and Two or Three Cupboards. It Is also Provided with a

Porcelain Sink and a Power Plug for Sterilization of Material. the Pharmacy Has Built-In Shelves and Cupboards and a Working Table. a Diagnostic Laboratory of 3 × 4 Metres Is Provided adjacent to the Pharmacy Room.

2.5.19 Post-Mortem Platform

The Post-Mortem Platform Is a Raised Structure of 3 X 4 Metres with a Roof. It Is Used for Performing Post-Mortem Examination of Dead animals, and Is Kept at a Considerable Distance from the animal Shed. an incinerator Is Provided to Completely Burn off the Carcass of animals Suffering from Contagious Diseases.

2.5.20 Storing Space for Concentrates and Dry Fodder

Another Important ancillary Structure of animal Houses Is Concentrate and Dry Fodder Stores. for Uninterrupted Feeding of animals, Enough Feed and Fodder Must Be Kept Ready in the Stores. the Size and Type of Buildings for these Stores Depend on the Quantity of Feed and Fodder Required to Be Stored on the Farm. It Is advisable to Store the Sufficient amount of Concentrates Required for at Least Three Months. the Usual Space Requirement for Concentrate Godown Is 0.2 Cubic Metre Per animal. the Concentrate Store-Cum-Feed Mixing Room and the Ration Room are Located Near the Milking Parlour. in Smaller Farms, one Feed Store Near the Milking Parlour Could Be Sufficient. the Structure of the Feed Room Is Made in Such a Way That It Is Damp-Proof and Rodent-Proof.

Dry Fodder Such as Hay or Crop by-Products Like Straws are Fed to the animals on a Daily Basis, and therefore, Facilities for their Proper Storage are Essential. Straws are available During the Harvesting Season at Cheaper Rates, and It Would Be Economical to Store the Whole Quantity of Straws Required for the Year in one Go, During the Harvesting Season Itself. the Size of the Shed Needed to Store Dry Fodder Can Be Calculated Based on the Quantity Required by the Number of animals at the Farm.

The Size of the Hay Godown Must Meet the Requirements of Hay for at Least Two Months. the annual Quantity of Hay Required Can Be Calculated Based on the Number of Days in a Year When Hay Is Necessary.

2.5.21 Ration Room

In a Medium-Sized Farm, a Room of at Least 3 X 4 Metres Is Provided Near the Milking Shed, Which Stores Concentrates to Meet the Daily Requirements of animals. It Is Important to Ensure That the Ration Room Is Damp- Proof and Rodent-Proof.

2.5.22 Chaffing Shed

The Chaffing Shed Is Used for Cutting the Grasses and Green Fodder into Very Small Pieces with the Help of the Chaffing Machine, to Improve the Overall Palatability and Digestibility of the Green Fodder. the Floor of the Chaffing Shed Is Such That It Facilitates the Chaffing and Removal of the Chaffed Fodder.

2.5.23 Silos

The Nutritive Value of the Fresh Green Fodder Is the Highest and the Nutritive Value of the Fodder Decreases When It Is Dried. therefore, Through the Process of Silage, the Nutritive Profile of the Green Fodder Is Maintained. Silage Is a Method to Preserve the Green Fodder for Cows and Buffaloes for Consumption at a Time When Green Fodder Is Not available in Required Quantity. the Grasses and Green Fodder are Cut and then Fermented to Retain

as Much Sugar and Proteins Present in them. Many Microscopic organisms Living in the Grasses and Green Fodder Carry Out the Process of Fermentation to Convert the Green Fodder and Grasses into Silage. Silos are the Structures Meant for Storing Silage. the Types of Silos Could Be tower-Type, Pit-Type, or Trench- Type. in India, Trench-Type of Silos are More Practicable and Convenient. the Silos are Preferably Constructed Near the animal Shed. they are Constructed on Elevated Ground to Provide Sufficient amount of Silage During the Months of May to June and October to November, When there Is Shortage of Green Fodder. a Silage of Good Quality Weighs 0.40 to 0.48 tons/M3. the average Daily Requirement of Silage for adult Cow and Buffalo Is 10–13 Kg.

2.5.24 Wallowing Tank for Buffaloes

Wallowing Means Rolling or Lying in Mud or Water to Cool the Body. It Is a Natural instinct of Buffaloes to Wallow in Pond and Muddy Pools. Wallowing Is often Noticed in Summer Season. During High Environmental Temperature and Humidity, Buffaloes May Wallow at a Stretch Up to 5 Hours in Which they Completely Immerse themselves into the Water Except Nostrils and Chew with Half-Closed Eyes. Buffaloes Experience Summer Stress as they Have Dark Skin, Sparse Hair, Less Number of Sweat Glands Which Have Less Sweating ability and are Deeply Sited into the Skin. Besides Cooling, Wallowing also Helps in Removing Ecto-Parasites and Other Pests. It Is therefore Vital to Have a Wallowing Tank

in a Buffalo Farm as a Mechanism for Dissipation of their Body Heat. an average Wallowing Tank (40 x 60 Ft) Can accommodate about 100 adult Buffaloes at a Time. the Water of the Wallowing Tank Is Changed Every Week.

2.5.25 Dairy Section

The Primary Function of the Dairy Farm Is to Produce Milk. therefore, Suitable arrangement Is Made for Hygienic Handling, Processing and Disposal of Milk. the Dairy Section Has the Following Components

2.5.26 Milk Receiving Room: Collection of Milk Is an Important activity in the Day-To-Day Dairy Farm Operations. in the Milk Receiving Room, the Milk Is Collected after Milking, Weighed and Stored in Cans for Small Periods Before Being Transported to the Bulk Milk Room and Ultimately Reaches Milk Plants or Market. the Doors and Windows of the Milk Receiving Room are Made Fly-Proof to Ensure Hygiene. the Flooring of the Room Is Made Impervious and Wear Resistant. the Dimensions of a Milk Receiving Room Depend Upon the Quantity of Milk Handled Daily. in a Large Farm, the Recording-Cum-Milk Cooling Room, the Room for Milk Utensils and Equipment, and Washing Room are Constructed Separately.

2.5.27 Bulk Milk Room and ancillary Structures:

In a Large Dairy Farm, there Is a Separate Bulk Milk Room, the Floor area of Which Is at Least 4 X 5 M. the area of a Bulk Milk Room Depends Upon the amount of Milk Produced Per Day. after the Milk Is Collected in the Milk Receiving Room, It Is Transferred in Cans to the Bulk Milk Room. the Milk Cans are Placed Here in insulated Tanks Filled with Refrigerated Water. to inhibit Bacterial Growth and Prevent Spoilage of Milk, the Temperature of Milk Is Kept around 4–5°C. an office Room, Compressor Room and Utensil Wash-Up Room are Located adjacent to the Bulk Milk Room.

2.5.28 Fodder Production Section

Continuous Supply of Green Fodder to the Ruminants Like Cows and Buffaloes Is a Prerequisite for the Health and Economy of the Farm.

2.5.29 Important Points in Nutshell: Cow Comfort

- When Cows are Confined, their Level of Comfort Is Determined by the Facility and Management. Good Comfort Equates with Good Production While Poor Comfort Results in Lower Production and a Higher incidence of Disease.
- High-Producing Milking Cows Will Lie Down for 12 Hours a Day If they are Provided with a Comfortable Place to Lie.
- Cows Provided with a Clean Dry Place to Lie Have Less Problems with Lameness and Mastitis
- Cows Provided with a Clean Dry Place to Lie Have Less Problems with Lameness and Mastitis
- Wet Bedding Material Encourages Bacteria to Multiply and Predisposes to Environmental Mastitis
- Non-Slip Flooring Will Reduce the Risk of injury and allow Cows to Show Signs of Oestrous

Furthermore, the Following Points to Be Strictly adhered to While Constructing the Farm towards the Shelter Management for Dairy animals Like:

- i. Comfortable animal Shelter Design: Physical Modification of the Shelter to Decrease Heat Gain by Radiation interception.
- ii. Proper Ventilation: Remove Heat, Moisture, and Odour Created by Livestock, and Replenish the Oxygen Supply by Bringing in Drier, Cooler Outside air. adequate air Exchange also Removes Gases Such as ammonia (Nh4), Hydrogen Sulphide (H2s), and Methane (Ch4) Which Can Be Harmful to Both animal and the Farmer's Health.
- iii. Using Shades: for Tropical Climate Condition Loose Housing System Is Considered Most appropriate. the Longer Side of the animal Shelter Should Have an East-West orientation. This Reduces the amount of Direct Sunlight Shining on Side Walls or Entering the House. in addition to This Roof Can Be Extended with Shading Material, and the Vertical Shading Moved to the Outside of the Roof. Such Devices Give Much Better Protection from Direct Solar Radiation and Sun. the West Side of the Shed Can also Be Protected Similarly and Fitted with Side Covers and Gunny Bags or Curtains. the Height of the Shed Structure Should Be Greater Than 2.4 Meters Tall to allow Sufficient air Movement Under Shade. However, Tall Structures (More Than 305 Meters High) are Not Economically Viable.
- iv. Increasing air Flow: to increase air Flow Two Main approaches May Be Used. one Is to install Large Fans So That air Movement Is increased and the Second Is to Open the Side of the Shed. the Netting Can Be Raised to increase air Flow During the Summer and Lower During the Winter. increasing the Roof Venting Is Yet another Option That May Be Used for animal Sheds. Double Wall approach Is an Effective and Proven Technology in Structural Design for increasing or Reducing Temperature.
- v. Using Sprinklers: High Pressure Irrigation-Type Sprinklers Can Improve inexpensive Wetting of animals, Especially When Coupled with Fans, to increase air Movement. altering the Microclimate of the Sprinkled area Helps in Improving the Wellbeing of Feedlot Cattle Under Extreme Environmental Condition by Reducing Body Temperature.
- vi. Forced Ventilation Using Fans: the Role of Fans Is to increase Heat Loss by

Convection. Fans Can Reduce the Body Temperature by 0.3 to 0.4 ° C, Provided That the Temperature of the Provided air Is Lower Than the Surface Temperature of the animal.

- vii. Simple Management tools includes Wetting the Body by Wet Gunny Bags, Bathing the animal Frequently, Growing Trees around, Green Grass in the Paddocks, Hanging Wet Gunny Bags against the Direction of Wind, increasing the Number of Feedings, Placement of Feed and Water So That they are always in the Shade, artificial Lighting increase Consumption at Night and avoiding the Handling of Cows During the Hottest Part of the Day, Micro-Climate Management.

2.5.30 Cleaning of animal Sheds

- The Easy and Quick Method of Cleaning animal House Is with Liberal Use of Tap Water, Proper Lifting and Disposes all of Dung and Used Straw Bedding, Providing Drainage, to the animal House for Complete Removal of Liquid Waste and Urine.
- The Daily Removal of Feed and Fodder Left Over in the Manger, Reduces the Fly Nuisance.
- Periodical Cleaning of Water Through Eliminates the Growth of algae, Bacterial and Viral Contamination and Thus Keeps the animal Healthy.

2.5.31 Sanitation in Dairy Farm

- Sanitation Is Necessary in the Dairy Farm Houses for Eliminations of all Microorganisms That are Capable of Causing Disease in the animals.
- The Presence of organisms in the animal Shed Contaminates the Milk Produced Thus Reducing Its Self-Life, Milk Produced in an Unclean Environment Is Likely to Transmit Diseases Which affect Human Health: Dry Floorings Keeps the Houses Dry and Protects from Foot injury.
- Similarly, the Presence of Flies and Other insects in the Dairy Farm area are Not only, Disturbs the animals But also Spreads Deadly Diseases to the animal's Egg. Babesiosis, theileriosis.

2.5.32 Sanitizers

- Sunlight Is the Most Potent and Powerful Sanitizer Which Destroy Most of the Disease Producing organism. Disinfection of animal Sheds Means Making these Free from Disease Producing Bacteria and Is Mainly-Carried Out by Sprinkling Chemical agents Such as Bleaching Powder, Iodine and Iodophor, Sodium Carbonate, Washing Soda, Slaked Lime (Calcium Hydroxide), Quick Lime (Calcium Oxide) and Phenol.
- **Bleaching Powder** - This Is also Called Calcium Hypo Chloride. It Contains Upto 39 % available Chlorine Which Has High Disinfecting activity.
- **Iodine and Iodophor** - This Is Commercially available as Iodophors and Contains Between 1 and 2 % available Iodine Which Is an Effective Germicide.
- **Sodium Carbonate** - a Hot 4 % Solution of Washing Soda Is a Powerful Disinfectant against Many Viruses and Certain Bacteria.
- **Slaked Lime and Quick Lime** - White Washing with these agents Makes the Walls of the Sheds and the Water Troughs Free from Bacteria.

- **Phenol** - Phenol or Carbolic acid Is Very Disinfectants Which Destroy Bacteria as Well as Fungus.

2.5.33 insecticide

- Insecticides are the Substances or Preparations Used for Killing insects.
- In Dairy Farms, Ticks Usually Hide in Cracks and Crevices of the Walls and Mangers.
- Smaller Quantities of insecticide Solutions are Required for Spraying.
- Liquid insecticides Can Be applied with a Powerful Sprayer, Hand Sprayer, a Sponge or Brush; Commonly Used insecticides are Ddt, Gramaxane Wettable Powders, Malathion, Sevin 50 % Emulsifying Concentration Solutions.
- These are Highly Poisonous and Need to Be Handled Carefully and Should Not Come in Contact with Food Material, Drinking, Water, Milk Etc.

2.6 Legal/Regulatory formalities

The Legal Requirement Varies from State to State and Whether You also intend to Process Milk (Make Milk Products). for a Normal individual Dairy Farm, the First Point of Contact for Registration (Mainly for the Purpose of Getting incentives, Etc.) Is the Local Veterinary and Dairy Development Department (Contact District/Block office of these Departments Near Your Farm). If Your Farm Is a Part of a Registered Dairy Cooperative Society, You are Not Required to approach any Other Government authority.

As Far as the License Is Concerned, You Need to Contact Veterinary or Related officer of Municipality Corporation or Local Panchayat. for Large Farms, Permission May Be Required from the Pollution Control Board.

2.7 Plan of animals

Size of Dairy Farm

The Size of the Dairy Farm to Be Decided by the Farmer/ Entrepreneur at the Very Start of the Idea for Starting a Farm.

For a Farm to Be Profitable, It Is Essential to Set-Up a Small Farm with a Minimum 4-5 Cows to Start with, Out of Which atleast 3 Cows Should Be in Milking, and 2 Cows Pregnant. and the Selection of the Cows to Be Carefully Made.

Selection of animal Stock

In Dairy Farming, Selection of the animals and the Breed Is Very Important. the Selected animal Should Be a Milch Breed Capable of Performing Optimally in the Given Environment and available Resources inputs. Holstein Friesian Is the Most Popular Milk Breed in the World Followed by Jersey. these Two Breeds are Extensively Used for Dairy Farming in India.

While Starting a New Dairy, the Dairy Farmer Must invariably Buy the First Cattle from Other Cattle Farmers. in This Context, the Cattle Farmers are always advised to Buy Cattle from Such an organized Dairy Farm Where Complete information Regarding the Breed and the Lineage of Cattle Is Maintained

and If the Cattle are Not available at any Such an organized Dairy Farm, then Buying Cattle from Cattle Market, or animal Fair Remains the only Option.

However, the Entire Business of Cattle Purchase in India Is Controlled by animal Brokers/ Contractors or Middlemen Wherein these Transactions are Opaque and, in Most Cases, are Not in the interests of the Purchasing Farmers. Thus, the Choice/Selection of Suitable Cattle Is of Utmost Importance. the Following are Some Important Pointers That Should Be Kept in Mind When Purchasing Cattle:

- Milking/Extraction (Milk) Should Be Tested Thrice a Day (Morning – Evening – Morning) Under the Supervision of the Farmer. This Helps in Knowing the average Production of Milk by Cattle.
- When the Cattle are Being Milked, Keep a Record of How Much Time the Cattle Take for Milking or Letting Down.
- Examine This aspect Closely, Whether all the Four Udders of Cattle are Working or Not. as a Thumb Rule, Usually, 45% of Milk Is Obtained from the Front Udders of Cattle While 55% Is Obtained from the Rear Udders.
- One Should Note, If It Takes the Same amount of Effort in Milking all Udders or Whether any Udder Is Relatively Hard While Milking. Such an Udder Can Be Troublesome in Future. Similarly, It Is also Necessary to See the Colour of the Milk, If the Colour Is Yellow or Red, or If there Is any Type of Discharge from the Udder, then the Cattle Might Be Suffering from Udder Disease.
- Observe If the Cattle are addicted to any Specific Type of Fodder/Feed or any Person for Giving Milk. If This Happens, then It Can Cause Problems Later.
- The Udder of Cattle Should Be Well attached to the abdomen. It Should Neither Be Dangling, Nor Should It Have any Kind of Lumps, Etc. Similarly, the Lower Part of the Udder Should Be 45 Cm above the Ground, So That there Is No Possibility of injury, Etc. Even If It Hits the Ground.
- Tall, Large, Clear, and Crooked Milk Veins Should Be Visible from the abdomen of Cattle to the Umbilical Region. This Gives an Idea of the amount of Milk Present in the Udder of Cattle.
- As Far as Possible, Cattle Which are in their Second or Third Trimester, Whose Delivery Is one and Half Months Old and Whose Child Is a Heifer Should Be Bought as the Maximum amount of Milk Can Be Obtained from This Type of Cattle When It Is in Its Fourth and Fifth Stage. information about Cattle's Lactation Period Is also Necessary.
- Buy Cattle Which Is alert, Can Move Well, Gets Up Easily and Is Neither too Fat Nor too Thin. also, Observe That the Cattle Do Not Turn Over often.
- Cattle with a Broad Chest, Bright Eyes, Slender Necks, and Wet Nostrils Should Be Selected. as Mentioned above these are Some General Characteristics Which Should Be Kept into Consideration While Selecting any Cattle. always Keep in Mind That Choosing Cattle for Purchase Is a Very Difficult Task as No Cattle Breeder Would Ever Want to Sell His Best or Good Cattle.

After Buying and Bringing the Newly Purchased Cattle to the Cattle Shed, Keep the Cattle Separate from Other Cattle for at Least 7 to 10 Days So That It Can Get Used to the New Environment. Similarly, If the Cattle Have any Disorder or Disease, It Can also Be Detected by This This Way.

2.8 inducting a New animal

Newly Purchased animals are one of the Major Sources of infection and May introduce New Diseases into Your Herd.

Once It Has Been Decided on What Type of animals are to Be Reared Based on available Resources, Purchasing Healthy animals, and Implementing Strict Protocols for introduction into the Herd Is one

of the Most Important Components to Prevent Diseases Occurring in the Herd Due to introduction of a Newly Purchased animal. Determining the age of the Newly Purchased animal Will also Be a Helpful tool.

This Section Consists of the Following Sections: a. Purchasing a New animal. B. Determining the age of an animal. C. inducting a Newly Purchased animal into the Herd

Purchasing a New animal

Breed

A Decision on What Breed one Wants to Keep Depends on the Resources available with the Farmer and the Suitability of the Breed to the Locale. a Decision on the Breed Should Be Taken only after Detailed Discussions with Your Local Veterinarian/Krishi Vigyan Kendras (Kvks)/Kisan Call Centres

Source

Known Disease Free Farms (Either Govt or Private) Where Regular Testing for Diseases Like Tb, Jd and Brucellosis are Done and Positive animals Removed Would Be Ideal Sources to Procure Your animals.

It Is Better to Buy animals from the Owners' Premises Rather Than from Cattle Markets/Shanties Since Chances of the animal Being Exposed to Diseases Is High at these Locations

General Signs to Observe for in Healthy animals During Purchase

Eyes: Bright, Clear and Not Runny (No Discharge), Crusty or Bloodshot.

Nose: Cool, Moist Muzzle, with Frequent Licking; Breathing Should Be Regular and Not Laboured; Beware of Discharge, Coughing, Wheezing or Irregular Breathing.

Coat: Glossy, Clean and Un-Matted, Free of Ticks/Lice, Other Parasites or Eruptions. Y Weight: average Weight for the Breed; Beware of Emaciated or Thin animals.

Attitude: Curious, alert and Contented; Beware of Cattle That Stand apart from the Herd, That Seem Disinterested or That Show Signs of a Bad Temper.

Mobility: Walking Should Be Easy and Free of Limps; Beware of Slow or Uneven Gaits or Hunched Positions When Sitting; the animal Should Be able to Rise from Seated Positions with Ease.

Udder: Healthy; Size Isn't Necessarily an indicator of a Good Udder. It Should Sit forward with Prominent Milk Veins, Not Sag and Not Be too Meaty. Observe the Cow When She Walks, the Udder Should Not Show too Much Sideways Movement.

Body Score: This Is an Important indicator of the Health of the animal. an animal in Good Health Will Have a Body Score Between 3-4. (See Chapter on Body Scoring)

History: It Is Important to Have a Record of the Detailed History of the animal on Number of Calvings, Recorded Milk Yield During Previous Lactation, any Specific Disease Occurrence Like Mastitis, Prolapse of Uterus, Rop, Dystocia, Hypocalcaemia Etc.

Age : Though Not Directly Related to Health, the Farmer Should also Ensure the age of the animal by Referring to Its Dentition.

Determining the age of an animal

Determining age of the animal Is Important While Purchasing a New animal Since the information Provided by the Seller May Not always Be Reliable.

Determining the age by Detention

- i. At Birth to one Month, Two or More Temporary incisor Teeth are Present. by First Month all 8 Temporary incisors appear.
- ii. the Central Pair of Temporary incisors are Replaced by Permanent ones Which attains Full Growth by 2 Years (Thin arrows).
- iii. Dentition of a 3 Year Old Cattle with 2 Pairs of Fully Developed incisors
- iv. Dentition of Cattle aged around 4-5 Years with 4 Pairs of Permanent incisors.
- v. The Third Permanent incisor Erupts at around 30 Months of age (Thick arrow)
- vi. The Fourth Permanent incisors Erupt after 30 Months.
- vii. The Second Pair of incisors Is Fully Developed at 3 Years.
- viii. By the 4-5 Years the animal Has a Full Set of Permanent incisors. (In Buffaloes by 5-6 Years) by the Sixth Year, the Central incisor Shows Wear and Leveled top.

The Wearing Progresses Steadily after the Sixth Year and by the Tenth Year, all the incisors Show Significant Wear and Space in Between them.

Inducting New animals

Inducting a Newly Purchased animal into the Herd Is Very Essential and the Below Given Points to Be Followed.

Quarantine (Isolating the animal)

The Newly Purchased animal Should Be Kept in Isolation without Contact with the Other animals atleast for 3 Weeks. one Should attend to the Newly Purchased animal only after attending the Herd.

Avoid attending to the Existing Herd after Contact with the Newly Purchased animal without a Proper Wash and Cloth Change. Carry Out Routine Deworming, Fluke Treatment (Based on Endemicity) and Vaccination During the Period of Quarantine.

For Lactating animals, Milk the Newly Purchased animal Separately and, only after Milking all the Other animals in the Herd.

Always adopt an “All-In all-Out” System, Clean and Disinfect the Quarantine area Before inducting another animal(S). Testing During Quarantine the Following Tests Should Be Performed While in Quarantine.

1. for in-Milk animals, Test for Sub-Clinical Mastitis (Scm)— If Found Positive, they Should Be Treated and Retested Till Negative Results are Obtained. in Case these animals Do Not Become Negative for Scm on Subsequent Tests, they are Most Probably Chronically infected.
2. Test for Brucella
3. Test for Bovine Tb (Btb)
4. Test for Johne’s Disease (Jd) the Following Regional Laboratories May Be Contacted for Further information: Note: an animal Testing Negative Does Not Necessarily Mean It Is Free from Disease

The Local Veterinarian Should Be Contacted for Taking Samples for the Test or Testing the animals (Btb/Jd) and for any Other advise. Many State animal Husbandry Departments also Do the Tests in their Laboratories.

Transportation of animals

All Steps Should Be Taken to avoid Stress While Transportation. adequate Water, Space, Feed, Water and Rest Should Be Provided at Regular intervals While Transporting, Since Stress Predisposes the animal to Various Diseases. the Flooring Should Be Provided with Some Bedding Material Like Paddy Straw.

Combination of animals to Be Purchased

Preferred Dairy animal Is Buffalo (Murrah/Graded Murrah/Nili-Ravi), indigenous Cows (Sahiwal, Red Sindhi, Gir, Rahti, Deoni, Tharparkar, Kankrej Etc) or Crossbred Cow.

2.9 Sourcing of animals

Sourcing of animals Is a Very Important Task While Setting Up a Dairy Farm. one Needs to inspect all Dairy animals Personally Before Buying, including Several Milking Tests. the animal Should Be Healthy and Vaccinated against Disease. Ideally, Purchase the animals Right after Calving, on Its Second or Third Lactation (When Milk Production Is Highest). Need to Wait to Buy the Second Half of the Herd Until the First Group Is about to Go Dry, So Your Farm Can Produce Milk Year Round.

Contact Government institutions, University agricultural Extensions, and Established Dairy Farms While Sourcing the animals.

2.10 Financial Plan - Financial Linkage

Financial assistance available from Banks/Nabard for Dairy Farming.

Nabard Is an apex institution for all Matters Relating to Policy, Planning and Operation in the Field of agricultural Credit. It Serves as an apex Refinancing agency for the institutions Providing investment and Production Credit. It Promotes Development Through formulation and appraisal of Projects Through a Well organised Technical Services Department at the Head office and Technical Cells at Each of the Regional offices.

Loan from Banks with Refinance Facility from Nabard Is available for Starting Dairy Farming. for Obtaining Bank Loan, the Farmers Should apply to the Nearest Branch of a Commercial or Co-Operative Bank in their area in the Prescribed application form Which Is available in the Branches of Financing Banks. the Technical officer attached to or the Manager of the Bank Can Help/Give Guidance to the Farmers in Preparing the Project Report to Obtain Bank Loan.

For Dairy Schemes with Very Large Outlays, Detailed Reports Will Have to Be Prepared. the Items of Finance Would include Capital asset Items Such as Purchase of Milch animals, Construction of Sheds, Purchase of Equipment Etc. the Feeding Cost During the initial Period of one/Two Months Is Capitalized and Given as Term Loan. Facilities Such as Cost of Land Development, Fencing, Digging of Well, Commissioning of Diesel Engine/Pump Set, Electricity Connections, Essential Servants' Quarters, Godown, Transport Vehicle, Milk Processing Facilities Etc. Can Be Considered for Loan. Cost of Land Is Not Considered for Loan. However, If Land Is Purchased for Setting Up a Dairy Farm, Its Cost Can Be Treated as Party's Margin Upto 10% of the total Cost of Project.

2.11 Purchase Plan

1. Immediately after Release of the Loan from the Bank or Financial institution, the Purchase the Stock of the Dairy animals Should Be Planned from a Reliable Breeder or from Nearest Livestock Market.
2. Should Select Healthy, High Yielding animals with the Help of Bank's Technical officer, Veterinary/Animal Husbandry officer of State Government, Etc.
3. Purchase Freshly Calved animals in their Second/Third Lactation.
4. Before Purchasing, ascertain actual Milk Yield by Milking the animal Three Times Consecutively.
5. Identify the Newly Purchased animal by Giving Suitable Identification Mark (Ear Tagging or Tattooing).
6. Plan to Vaccinate the Newly Purchased animal against Disease.
7. Plan to Keep the Newly Purchased animal Under Observation for a Period of about Two Weeks and then Mix with the General Herd.
8. Plan to Purchase a Minimum Economical Unit of Two Milch animals.
9. The Purchase the Second animal/Second Batch Should Be Done after 5-6 Months from the Purchase of First animal.
10. As Buffaloes are Seasonal Calvers Purchase them During July to February.
11. As Far as Possible, Plan to Purchase the Second animal When the First animal Is in Its Late Stage of Lactation and Is about to Become Dry, thereby Maintaining Continuity in Milk Production Vis-A-Vis income. This Will Ensure availability of adequate Funds for Maintaining the Dry animals.
12. Plan and Follow Judicious Culling and Replacement of animals in a Herd.

Quotations for Purchase

Taking Quotations of the animals to Be Purchased from Different Locations and Different Brokers Is Very Important as It Would Differ from Place to Place and Different with the Different Stages of Lactation, Litres of Milk Yield, age Etc. all This Will Help in Deciding the Right Kind of animal to Be Purchased, without Being Exploited or Cheated by the Middlemen or Brokers.

The Cost of the animals Differs When they are Purchased from a Local Farm, Known Source, Shandy or from a Breeding institute Where all the Details - the Pedigree of the animal Is Maintained Systematically

Identification of Right Vendors

The Entire Business of Dairy Cattle Purchase in India Is Controlled by animal Brokers/ Contractors or Middlemen Wherein these Transactions are Opaque and, in Most Cases, are Not in the interests of the Purchasing Farmers. So Utmost Care Should Be Taken to Identify the Right Vendor While Purchasing a Dairy animal. the Farmer Should Check the Price of the animal at Different Places and Draw Upon Conclusions and Get Educated on the Basic Criteria to Be Looked into While Purchasing a Dairy animal. This Would Help the Farmer from Being Cheated or Exploited by the Vendor or the Seller.

Needs and Purchase of Farm Machineries

The Farm Machineries – Milking Machine, Chaff -Cutter Etc to Be Purchased Based on the Quotation from Three Dealers. the Purchase to Be Made Based on the Lowest Quote and the Best Product available.

Equipment and Machinery Required for Dairy Farm

The Type and Number of Equipment and Machinery Required in a Dairy Farm Depends on the Level of Mechanization and the total Number of animals. However, Some of the Essential Machinery and tools are Chaff Cutters, Milking Utensils, and Other Minor Implements, Which are Required Irrespective of the Number of animals.

If the Dairy Farm Is Situated in an area with Extreme Weather Conditions, Cooling and Heating Devices are Required, Especially for Young Calves, Ill, injured and Pregnant animals. in Case the Number of Milch animals Exceeds 50, Milk Cooling Devices, Generator Set and a Utility Vehicle are also Essential for Storage and Selling of Milk, Etc. If You are interested in Keeping a Large Number of animals, It Is Better to Have Some area Designated for Fodder Cultivation. in This Case, Farm Equipment Like Tractor, Seed Sowing, Fodder Harvesting and Processing Equipment are also Required.

Machineries Required for a Small Farm

Section	Equipment and Machinery
Fodder Production	Tractor
	Trolley
	Large Weigh Bridge
	Fodder-Reaper-Cum-Binder
Feed Processing	Chaff Cutter (Manual or Motor-Operated)
	Feed Grinder
	Feed Mixer
Dairy Section	Cooling/Heating System
	Milking Machine
	Animal Weigh Bridge
	Electrical Dehorner
	Tagging Set
	Branding Numbers
	Drenching Bottle

	Hoof Trimmer
	Ropes, Fire Controlling Equipment, Iron Chains, Etc.
	Generator/Electricity Supply
	Continuous Water Supply/Tubewell with Motor

2.12. Security Measures to Protect the Farm, animals, and Equipment

Farm Security

Farm Security Is Simply the Different Security Measures That Farmers Will Use to Ensure the Protection of their Business. these Farm Security Measures Could Be anything from Employing Security Guards to Do Regular Patrols of a Farm to installing Cctv Monitoring Equipment across Different areas of Your Property.

Need for Farm Security Measures

Employees and Visitors Security

- Need to Ensure animals are Handled by the Proper individuals, Dairy Farm Owners Carefully Screen Job applicants and Conduct Background Checks.
- It Is also Important for Dairy Farmers to Keep Record of Visitors, to Whom access Is Limited and Supervised.
- Dairy Farms are Businesses That Use Large Equipment Like Tractors and Feed Trucks, So Visiting a Farm Unannounced or Going in Unauthorized areas During a tour Could Result in injury. If Visiting a Dairy Farm, You Might Be asked to Park in areas away from animal Handling Sites or to Wear Closed-Toe Shoes with Plastic Covers to Limit Spread of Disease and toxins Coming onto the Farm

Animal Security

New animals are Purchased from Healthy Herds to Help Farmers Protect their Cows. the Health Status of Each animal Is Checked Before It Is introduced to Other animals in the Herd.

To Keep animals Healthy, It Is Recommended for Visitors to avoid touching animals and to Wash their Hands Before and after Visiting a Farm.

Buildings and Ground Fences, Gates, Security Lighting and alarms Protect Farm Buildings and Grounds. Typically, Dairy Farms Have a Single Entrance and Exit for the Farm with the Farm Name and Contact Number Posted.

Always Follow Posted Signs and Contact the Farm Owner Before Entering the Property.

Access Is Restricted to areas Where Milk, Feed, Farm Chemicals and animal Health Products are Stored.

Farms Will often Employ Farm Security Solutions Due to the Variety of Crimes That Threaten the Safety of a Farm. Below, We Have Listed the Most Popular Farm Crimes.

Livestock theft

One of the Biggest Crimes That affect Farmers Is the theft of Livestock – the Cow as the Thieves Can Sell them and Make Easy Money.

Machinery theft

Livestock Isn't the only Thing That Is Stolen from Farms, Machinery Equipment Like Milking Machines, Tractors are also Commonly Stolen. Criminals Will Steal Farming Equipment to Sell to Other Businesses.

Arson

As Farms are often in Remote Locations, This Can Cause them to Become a Huge Target for arson Crimes. Serious incidents of arson Can Cause Farms to Lose their Livestock and Machinery.

Dog attacks on Livestock

Dogs attacking Farm Livestock Is another Big Concern for Many Farmers. Dog attacks Typically Happen When Dogs Have Been Let off their Leads Near Farming areas. If a Dog Does Chase or attack a Farm animal, This Can Cause Farm animals to Become Stressed, injured or Even Killed.

Securing Measures

Due to all the Different Types of Crimes That Farms Experience, It Is Important for all the Farmers to Employ Good Security Measures and Follow Farm Security Tips to Ensure the Protection of their Farms. Below, Is Listed and Explained Various Security Tips Like:

1. Hiring Security Guards

The First Farm Security Solution Is Employing Security officers on the Farm. Security Guards Have Been Known to Provide Strong Security and the Presence Can instantly Showcase That the Farm Is Well Protected. Farm Security Guards Can also Protect a Farm by Doing Regular Routine Patrols around the Farmland and by Using Cctv Equipment to Monitor Different areas at the Farm. Property.

2. installing Farm Security Cctv

Another Good Farm Security Tip Is installing Cctv Cameras. Security Cameras Have Been Known to act as a Visual Deterrent against Thieves. and Cameras Can also Be Effective in Reviewing and Monitoring Blind Spots on a Farm That a Guard Might Not Be able to Patrol.

Furthermore, Farm Cctv Security Cameras Can also Provide Farmers with Evidence; for Example, If an incident of Crime Is Committed, Farmers Can Use a Camera's Recorded Footage as Evidence within a Court of Law.

Security Cameras Should Be Placed in areas on a Farm Which Is the Most Vulnerable Such as:

- At the Front of Buildings.
- Near Farm Gates.
- Near the Livestock.

- Near any Entrances or Exits on the Farm.

3. Buy Security Locks for Farm Gates

One of the Most Common Ways That Thieves are able to Break into Farms Is Through Farm Gates. So, It Is Important That all Farm Gates are Well Protected. one of the Best Ways to Protect Farm Gates Is by Buying Security Locks for them.

Security Padlocks add an additional Layer of Protection to a Farmer's Gate, and they Can Make It Harder for Thieves to Break in.

Another Way to Protect Padlocks on Farm Gates Is by Covering them Up as This Can Stop them from Being Cut Through.

When You are Considering Which Security Locks to Buy for Farm Gates, It Is Important That You Choose Locks Which are Quite Strong and That are Made Out of a Good Material.

4. installing Farm Security Lights

Another Way That Farmers Can Employ additional Security on their Property Is by installing Farm Security Lights. Security Lights Can often act as a Visual Deterrent against Thieves and Will often Provide Farmers Will an Extra Layer of Protection.

Security Lights Will Be Used by Farmers to Give the Impression to Burglars That there Is Someone Present at the Farm.

5. installing Farm Security alarms

Farm Security Systems and alarms are another Good Security Measure That Farmers Can Use. Security alarms Can act as a Visual Deterrent against Thieves, and they Can often Scare Criminals away Through the Loud Noise That they Sound When they are Triggered.

6. Conduct Risk assessments on the Farms

It Is Important That Farmers Make Sure That Know Which areas on their Farms are the Most Vulnerable. one Way That Farms Will Be able to Do This Is by Conducting Regular Risk assessments.

Security Risk assessments allow Business Owners to Review What the Security Is Like in the Different areas on their Property and It also allows them to Brainstorm Which areas May Need More Security in Place.

Farmers Can Use Security Risk assessments to Get a Better Understanding of the Different Security Measures they already Have and to Help them Consider any additional Security Measures they May Need.

7. Brand the Machinery with Unique Serial Numbers

One Way That Farmers Can Protect their Farm Machinery, Is by Branding their Equipment with Unique Serial Numbers. although This Won't Completely Stop Machinery theft, It Has Been Known That Thieves are Less Likely to Steal Equipment That Has Noticeable Serial Numbers on them.

Branding Equipment Can also Be Helpful If It Does End Up Getting Stolen, as the Unique Serial Numbers Can Be Used to Help the Police Identify Stolen Equipment.

8. Employ Good access Control on Site

Finally, the Last Tip for Improving Security on the Farm Is to Make Sure That the Farm Has Good access Control. installing Good access Control around Key areas on the Farm, Such as the Main Entrances, Can increase Security on the Farm as It Can Stop Criminals from Striking at the Business.

3. DAIRY FARM- OPERATIONAL MANAGEMENT

Farm Management Is a Decision-Making Process in Which the available But Limited Production Resources are allocated to Selected Production alternatives, So as to Operate the Farm Business in Such a Way as to attain Some Set Objectives. the Objective Could Be Profit Maximization and/Or achieving Some Other Issues.

3.1 Breeding Management

Selective Breeding of Cattle and Buffalo to increase Milk Production Has Been Going on for a Long Time in Our Country and Has Made Commendable Progress in Certain areas. Majority of the Cattle and Buffalo are Still Not included in the Breed Improvement Programmes and That Is Why they are Low Milk Producers.

In order to increase the Milk Production in Our Country, there Is a Need to increase the Production Potential of Non-Descript Local animals Through Scientific Methods Like Crossbreeding. along with This, Improving the Milk Production Potential of indigenous Breeds in their Native Breeding Tracts Is also Equally Important.

Progeny Testing (Pt) and Pedigree Selection (Ps) Coupled with artificial insemination (Ai) and Milk Recording Have Been Identified as activities Leading to Steady Genetic Progress. for a Profitable Milk Business, It Is also Necessary for the Cow/Buffalo to Calve Every 1 to 1.5 Years.

Various aspects of Breeding include:

- Signs of Heat, Proper Time of insemination
- Advantages of artificial insemination (Ai)
- Drying off a Milking animal
- Normal Calving and Dystocia
- Infertility and Management of infertility
- A Brief on Progeny Testing (Pt)
- A Brief on Pedigree Selection (Ps)

Heat

- Heat Is a Period in Which Female animal Shows interest in Other animals.
- Generally, adult Heifer/Cow/Buffalo Comes in Heat after Every 21 Days But May Come in Heat any Time Between 18/24 Days. This Period May Last from 6 to 30 Hours.
- To Maximize the Productive Life of a Cow, It Must Be inseminated within 60- 90 Days after Calving. This Will Enable the Cow to Produce one Calf Per Year.
- Longer Calving intervals Have Detrimental Effects on Lifetime Milk Production.
- Heat Detection Is therefore a Critical Component of Good Reproductive Management.
- Recording the Dates of Cows in Heat and Dates of Services Is Necessary to Predict Future Heat or Calving Dates and to Manage the Cows accordingly.

Signs of Heat

- Repeated Bellowing.
- Swollen Vulvar Lips and Redness of Vaginal Passage Due to Congestion.
- Lifting of Tail.
- Thick, Sticky and Transparent Vaginal Discharge.
- Frequent Urination (Micturition). Reduced Feed intake and Decreased Milk Yield.
- Restlessness, Smells Other animals and Mounts on them.

- After 10-12 Hours in Heat, the animal allows a Bull or a Cow to Mount on Her. This Is the Right Time for Carrying Out ai.

Proper Time of insemination

- Insemination (Either Natural Service or by artificial insemination (Ai) Should Be Given Ideally after 10-12 Hours, or Maximum of 18 Hours of First Sign of Heat, That Is, If Heat Is Seen in the Evening, inseminate in the Following Morning. If Heat Persists in the Following Morning, another ai May Be Required on the Same Evening.
- If the animal Does Not Become Pregnant, It Will Come into Heat after 18-21 Days.
- After 21 Days of insemination the animal Should Be Observed for Symptoms of Heat, Especially During Early Morning and Late Evening Hours.
- Special Care Should Be Taken in Case of Buffaloes, as Symptoms of Heat are Not Very Prominent.

Advantages of artificial insemination (Ai)

- Artificial insemination (Ai) Is Carried Out by Using Frozen Semen Doses (Fsd) of High Genetic Merit (Hgm), Disease Free Bulls.
- It Prevents the Spread of Sexually Transmitted Diseases.
- During ai, Diseases of Reproductive organs are also Diagnosed.
- Through ai, Semen from one Bull Can Be Used to inseminate Many Cows at a Time.
- When Cow/Buffalo Comes to Heat, the animal Should Be artificially inseminated with Semen of Hgm Bull Through Trained ai Technician (Ait) instead Carrying Out Natural Service.
- Fsd's of Hgm Bulls May Be Used Even after Its Death.
- Ai Can Be Done at the Farmers' Doorstep Saving the Farmer Time.
- There Is Speedy Improvement in the Breed of the animal.
- Ai Is Easy and Cheap.

Post ai Monitoring

- 21 Days after ai, the animal Should Be Observed for Symptoms of Heat.
- 60 Days after ai, the animal Should Be Examined for Pregnancy.
- If the animal Does Not Conceive Even after Three inseminations, Consult the Veterinary Doctor.
- Ai Is a Simple and Cost-Effective Method to Improve Milk Production.

3.2 Drying-Off an animal

The Dry Period Is the Most Important Phase of a Dairy Cow's Lactation Cycle. for Optimal animal Health and Best Performance in the Next Lactation, Lactating animals Should Have an Opportunity to Rest and Regenerate Mammary Tissue Between Lactations. During This Phase, the Cow and Her Udder Prepares for the Next Lactation. Hence any abnormalities During the Dry Period Will Have a Negative Effect on the Cow's Health and Milk Production after Calving. Due to the Good amount of Milk they Produce, the Drying-Off Process Is often More Complicated for Dairy animals. Preparation for Drying off Should Begin at Least Two Weeks Prior to the Dry-Off Date with a Significant Change in the animal's Diet. Reducing the Energy Content of the Diet and Feeding Primarily a High-Fibre Diet Will Reduce the Nutrients available for the animal to Make Milk. This Is often all That Is Needed to Reduce Milk Production to a Level That Makes Dry off Safe and Simple.

Length of Dry Period: animals Should Be Dry for around 60 Days. If animals Have Prolonged Dry Periods, they Run the Risk of Becoming Obese, Experiencing Obesity-Related Diseases and Having Difficulty in Calving.

Procedure for Drying off

- Reduce Concentrate Feeding on a Tapering Basis 2-3 Weeks Before Drying-Off.
- Stop Concentrate Feeding 1-2 Weeks Before Drying-Off
- Restrict Feed intake If Milk Yield Is above 12 Litres Per Day.
- Reduce Dry Matter allowance to Maintenance Levels 3 Days Before Planned Dry-Off
- Stop Milking abruptly. Do Not Restrict Water access
- Check Dry Cows Visually on a Daily Basis after Drying-Off
- Ideally, Cows Should Be Kept at Pasture on a Maintenance Diet for a Week after Drying-Off.

Normal Calving & Dystocia

- Calving Usually Takes Place Normally without Help.
- A Sticky Vaginal Discharge Is Usually Seen a Day Before Calving.
- In Older Cows the Calf Is Usually Delivered 30-50 Minutes after the Water Bag Bursts, But May Extend Up to 2 Hours.
- In Heifers Calving May Take Up to 4 Hours after the Water Bag Bursts.
- If Calving Does Not Occur within the Prescribed Time after the Water Bag Bursts, It Is Known as Dystocia. in This Case, It May Be Required to Call a Veterinarian.
- If the Head and Two Front Legs appear after the Water Bag Breaks, there Is No Need to Call a Vet and Calving Usually Occurs Normally.
- A Gentle Traction of the Calf in a Downward arc by Holding the Front Legs May Be Done in the above Situation.
- Never attempt to Pull the Calf in any Other Position Other Than the one in Which Both Front Legs and Head are Visible (Not Even If one Front Leg and Head Is Visible).
- In Case an abnormal Presentation Is Seen or Nothing appears after the Water Bag Bursts, Call a Veterinarian Immediately.
- Delay in attending Will Further Complicate the Situation.

Post Calving Monitoring

- Under Normal Circumstances, an animal Should Come into Heat within 45 Days of Delivery.
- It Is Recommended to Breed the animal in the Subsequent Oestrus after the First Heat or within 60-90 Days.
- If the animal Does Not Come into Heat within a Period of 60 Days Post Calving, Consult a Veterinarian.
- Early Detection of Dystocia May Save the Calf.

Infertility

- Infertility Is a Temporary Disturbance in Reproductive Function Wherein the animal Cannot Become Pregnant. Normally an animal with a Healthy Reproductive Function Should Calve Every 12-14 Months.
- Infertility Causes Economic Losses to the Farmers Due to Delay in Maturity, Calving and Milk Production. the Farmer also incurs Losses by Maintaining an Unproductive animal.

- Infertility May Be Due to Various Reasons Like:
 - Diseases of Genital organs
 - Infectious Diseases
 - Absence of Heat, Repeat Breeding, Silent Heat, Cystic Ovary
 - Anatomical Causes
 - Faulty ai Technique

Management of infertility

- Inseminate at appropriate Time of the Heat.
- Repeat ai May Be Required in Cases of Prolonged Heat for Conception to Occur. Close Observation Is Required to Detect Silent Heat, Especially in Buffaloes.
- Provide Proper Nutrition Right from Birth of the animal.
- Provide adequate Quantities of Mineral Mixture Right from Birth of the animal.
- During Summer Season, Reduce Heat Stress on the animal by Providing Clean Drinking Water at all Times and adequate Shade or Cooling Systems.
- Ascertain Whether the Personnel Providing ai Services Is adequately Qualified.
- Consult a Veterinarian If a Regularly Cycling animal Has Not Conceived Even after 3 inseminations to Identify the Problem. Repeated inseminations May Cause Permanent Damage to the Reproductive organs.
- Animals with anatomical Conditions May Not Conceive.
- Infection/Diseases of Reproductive Tract also May Lead to infertility. Consult a Veterinarian for Proper advice and Treatment.

Factors Responsible for Conception During a Normal Heat Cycle

- Timely Heat Detection Is Sole Responsibility of the Farmer.
- Proper Handling of Semen, Proper Time of insemination, Proper ai Technique and Site of Deposition of Semen are in the Hands of Trained Personnel (Vets or ai Technicians).
- It Is therefore Very Important to Ensure That ai Is Being Done only by Trained Personnel to avoid Complications or Problems Later on.
- A Healthy Cross Bred Heifer Should Come into Heat by 18 Months or Earlier.
- Buffaloes and Local Breeds May Take More Time to Mature (Around 24 Months).

Importance of Data Management

Databases Play an Important Role in Making True and Healthy Decisions. with the Data Stored for a Long Time in Livestock Enterprises Will Facilitate increasing the Productivity in animal Production, Revealing animal Breeding Values, Ensuring the Breeding Needs of the Desired Characteristics, Making Efficient Breeding organizations, Determining the animals to Be Sorted and Kept. therefore, Earning High income Will Be Easier as a Result of them. one of the Most Important Factors affecting Success in animal Husbandry Is the Methods of animal Breeding and Genetic Success Obtained from these Methods, the Status of Producer Enterprises, Determination of Product Prices according to Quality, and Strong animal Husbandry organizations. information and Technology Sharing are Important in the Effectiveness of these organizations. the Most Prominent Factor on the Basis of animal Breeding all Over the World Is the Records Kept by Creating a Database and the analysis Conducted accordingly. as a Result of the advances in the Field of Gene Technology and

Molecular Biology, Genomic analysis Has Been Implemented in a Database Based on animal Breeding. in addition to Bioinformatics information in animal Production, Creation of Database (E-Breeding) to Keep Records of inventory of all Stages, Breeding index, Pre-Breeding index, Parent, Importing information of Yield, and Breeding Values to Database are also Important in Terms of Creating Model of Breeding, Productivity in Livestock, and Reaching advanced Levels by Usage of Biotechnological applications.

Improving Productivity of Consecutive Generation

Dairy Cattle Genetics Can Help Us to Predict and influence If the Next Generation of Cattle Will Possess Preferred Characteristics Such as High Milk Production, Good Health and Favourable Management Qualities. Every Farmer Should Have a Genetic Plan to assess their Cattle and Make Sure their Next Generation Has these Qualities, to Make them Easier to Manage and More Profitable.

Controlled and Selective Breeding Can Help to Improve Milk Productivity in Dairy animals and increase Profitability for Your Farm, with the Identification and Selection of Better Parent animals Ensuring a High-Producing Next Generation. the Effects of Selective Breeding Build and Improve Over Generations So Your Herd Can Become More and More Profitable as Time Goes on. the More Selective You are in Choosing the Parents, the More Desirable You Can Ensure Your Next Generation of Calves.

Effect of Genetics on Milk Production

The Holstein Is the Highest Milk Producing Farm animal in the World and therefore the Most Popular Dairy Cow Globally.

Despite Producing More Milk Than any Other Breed, the Holstein Does Pose Problems. Due to artificial Selection, the Strain of Milk Production on Dairy Cows Is Sometimes associated with Reduced Health and Fertility. While Holsteins May Be Genetically Better at Producing Milk, Health Issues and Reduced Fertility Can Mean Higher Vet Bills and Lower Profit Margins. This Has Led to the Rise of Breeding Functional Traits into Herds to Counteract any Issues.

Dairy Crossbreeding Is one Way to Do This, Bringing Positive Traits from Different Breeds to Reduce Workload and increase Profits.

Selection of Traits in Dairy Cows

Genetic Selection of Dairy Cattle Is Important Because Certain Cattle Will Be Better Dairy Cows Than Others Based on their Performance and Productivity. in Dairy Cattle, Preferable Traits include Health, Efficiency, Manageability, and Fertility.

3.3 Factors affecting Breeding Efficiency

The Factors Which influence the Breeding Efficiency of Cattle are as Follows:

Number of Ova

The First Limitation on the Breeding Efficiency of Fertility of an animal Is the Number of Functional Ova Released During Each Cycle of Ovulation. Ovulation Is the Process of Shedding of Ovum from the Graafian Follicle. in the Case of Cow, Usually a Single Ovum Is Capable of Undergoing Fertilization only for a Period of 5-10 Hours. therefore, the Time of Mating insemination in Relation to Ovulation Is Important for Effective Fertilization

Percentage of Fertilization

The Second Limitation Is Fertilization of Ova. Failure to Be Fertilized May Result from Several Causes. the Spermatozoa May Be Few or Low in Vitality. the Service May Be Either too Early or too Late. So That the Sperms and Eggs Do Not Meet at the Right Moment, to Result in Fertilization.

Embryonic Death

From the Time of Fertilization Till Birth, Embryonic Mortality May Occur Due to a Variety of Reasons. Hormone Deficiency or Imbalance May Cause Failure of Implantation of Fertilized Ova Which Die Subsequently. Death May Occur as a Result of Lethal Genes for Which the Embryos are Homozygous. Other Causes May Be accidents in Development, Over-Crowding in the Uterus, insufficient Nutrition or infections in the Uterus.

Age of First Pregnancy

Breeding Efficiency May Be Lowered Seriously by increasing the age of First Breeding. Females Bred at a Lower age are Likely to appear Stunted During the First Lactation, But their Mature Size Is Least affected by their Early Breeding Stage.

Frequency of Pregnancy

The Breeding Efficiency Can Be Greatly Enhanced by Lowering the interval Between Successive Pregnancies. the Wise General Policy Is to Breed for the First Time at an Early age and to Rebreed at almost the Earliest Opportunity after Each Pregnancy. in This Way the Lifetime Efficiency Is increased. Cows Can Be Rebred in 9-12 Weeks after Parturition.

Longevity

The Length of Lifespan of the Parent Is an Important Part of Breeding Efficiency, Because the Return Over Feed Cost Is Greater in increased Length of Lifespan. also, It affects the Possibility of Improving the Breed. the Longer the Lifespan of the Parents, the Smaller the Percentage of Cows Needed for Replacement Every Year.

3.4 Management Practices to Improve Breeding Efficiency

Some of the Management Suggestions Which Will Tend to Improve Breeding Efficiency of Cattle are Listed Below.

- Keep accurate Breeding Records of Dates of Heat, Service and Parturition. Use Records in Predicting the Dates of Heat and Observe the Females Carefully for Heat.
- Breed Cows During Near the End of Mid Heat or Heat Period.
- Have Females with abnormal Discharges Examined and Treated by Veterinarian.
- Call a Veterinarian to Examine Females Not Conceived after Three Services.
- Get the Females Checked for Pregnancy at 45 Days to 60 Days after Breeding.
- Buy Replacements only from Healthy Herds and Test them Before Putting them in Your Herd.
- Have the Females Give Birth in Isolation, Preferably in a Parturition Room and Clean Up and Sterilize the area once Parturition Is Over.
- Follow a Programme of Disease Prevention, Test and Vaccination for Diseases affecting Reproduction and Vaccinate the animals against Such Diseases.
- Practice a General Sanitation Programme.
- Supply adequate Nutrition.
- Employ the Correct Technique.

- Provide Suitable Shelter Management.
- Detect Silent or Weak Heat, by Using a Teaser Bull.

Selection and Culling

Selection and Culling are the Two Sides of the Same Coin. Selection Is the Process in Which Certain individuals in a Population are included for Becoming the Parents of the Next Generation. automatically, Some are Excluded and Culled. Natural Selection Has Been Going on Since ages Where animals Which Were Stronger, Which Had Better Survivability and Which Were in More Unison with the Environment around them, Found a Better Chance to Reproduce.

Thus, Certain Genes for Certain Characters Got More Chance to Be Selected to form individuals in the Subsequent Generations. Since Domestication of Cattle, Man Has Been Looking for Superior Phenotypes in Traits Useful for Him and Selected Such animals to form the Parental Generation. This Is Manmade artificial Selection. Now Man Has Progressed one Step Further in Making Estimates of Genotypes from the Study of Phenotypes and Making Use of That information (In artificial) Selection.

3.5 Selection Methods

There Is only one Way to Select and That Is to Keep the Best and Cull the Poorest. the Various Selection Methods are Techniques for Identifying or Estimating the Genetic Values of individual Candidates for Selection. the Procedure Discussed Here apply to Selection for Quantitative Traits.

Performance Testing

Performance Test Is a Measure of the Phenotypic Value of the individual Candidates for Selection. Since the Phenotypic Value Is Determined by Both Genetic and Environmental influences, the Performance Test Is an Estimate, Not a Measure of the Genetic Value. the Occurrence of This Estimate Depends Upon the Heritability of the Trait I.E. on the Degree to Which the Genetic Value Is Modified by the Environmental influences.

Advantages

- Among Simple Procedures, the Performance Test Is the Most accurate.
- Environmental influences Can Be Minimised by Testing Candidates for Selection in the Same Pen or in Similar Environmental Conditions.
- The Measure Is Direct, Not on a Relative Basis.
- All Candidates for Selection Can Be Tested in Contrast to Progeny Testing Where only a Parent Can Be Tested.
- Generation intervals are Usually Short.
- Testing Can Usually Be Done on the Farm Under Normal Management Conditions.

Disadvantages

- Accuracy Becomes Low When Heritability Is Low.
- Phenotypes are Not available for one Sex or in Sex Limited Traits Such as Milk Yield.
- Traits Which are Not Expressed Until Maturity May Become Expensive or Difficult to Manage by Performance Tests Since Most Selection Decisions Must Be Made Before Maturity.

Performance Tests Should Be the Backbone of Most Selection Programmes. although Much Publicity Has Been Given to Other Selection Methods, It Remains a Fact That Most of the Progress in Livestock Improvement to Date Has Been Due to Selection on the individual's Own Phenotype I.E. Performance Test.

Pedigree Selection

A Pedigree Is a Record of an individual's ancestors including Its Parents. This information Is Valuable Because Each individual Possesses a Sample Half of the Genes from Each Parent. If We Can Precisely Know an individual's Phenotype, Little Is Gained by Considering Pedigree in Selection. Pedigree Considerations are Useful When We Do Not Have Sufficient accurate Records of Production of the individual. also, It Is Useful in the Early Selection When the Traits in Question Might Not Have Expressed themselves. It Is also Useful for Selection of Males When the Traits Selected for are Expressed only by the Female Such as Milk Production in Dairy Cattle.

Advantages

- It Provides information When Performance Tests are Not available for the Candidates.
- It Provides information to Supplement Performance Test information.
- It allows Selection to Be Completed at a Young age. Pedigree Records May Be Used to Select animals for Performance or Progeny Testing in Multi-Stage Selection Scheme.
- It allows Selection of Bulls Can Be Selected on the Milk Records of their Female Relatives.

Disadvantages

- Accuracy, Relative to alternative Selection Procedures Is Usually Low.
- Too Much Emphasis on Relatives, Especially Remote Relatives, Greatly Reduces Genetic Progress.
- Progeny of Favoured Parents are often Environmentally Favoured.
- Relatives often Make Records Under Quite Different Environments, Thus introducing Non-Random Bases into the Selection System.

Progeny Testing

In This Method We Evaluate the Breeding Value by a Study of the Expression of the Trait in Its offspring. individuality Tells Us What an animal Seems to Be, His Pedigree Tells Us What He Ought to Be, But the Performance of His Progeny Tells Us What He Is.

Progeny Testing Is, of Course, a Two-Stage Selection System Because Some Preliminary Selection Determines Which animals First Produce Progeny Followed by Further Culling of these Which Produce Poor Progeny.

Advantages of Progeny Testing

- High accuracy When Many Progenies are Obtained.
- Disadvantages Progeny Testing
- Long Generation interval.
- Requires High Reproductive Rate.
- Low Selection intensity.

Show Ring Selection

Selection on the Basis of Show Ring Performance Has Had Considerable Value in the Past. Essentially This Selection Has Been Directed towards Bringing the Conformation of the animal to Some Ideal Conformation.

This Improvement Has Been Based on Two Goals:

- (I) Improvement in Conformation, and
- (ii) Correlated Response.

Improvement of Conformation Has Economic Value Because a Part of the Sale Price Is Determined by the Conformation of the individual. the Ideal Type Was Chosen So That, in the Opinion of the Judges, the animal Possessing This Conformation Was Most Likely to Be a Profitable Producer. in Other Words, the Judges Were attempting to Stress Traits of Conformation Which are Corrected with Productive ability.

With the advent of Record Keeping It Was Found That Direct Selection for Performance Traits Resulted in Much Faster Progress Than Selection Through Correlated Conformation Traits. also, When Subjected to intensive Study, Many of the Correlations Between Performance and Show Ring Were Found to Be of Non-Genetic origin.

If the Correlations are of Genetic origin, Direct Selection for Performance Should Improve Conformation as Well as the Reverse Situation. the Show Ring Has Been a Good forum for Discussion of What Constitutes Ideal Type and Good Management and Has Produced Dramatic Changes in the Conformation of Some Species.

This Has Resulted Primarily from Education of the Breeders, However, for Most animals Which are Presented in the Ring are Good and Selection Differential among these animals Is Usually So Small as to Produce Little Change.

Advantages of Show Ring Selection

- It Enables Breeders to Exchange Ideas and Experience.
- It allows Comparisons among Superior animals Both within and Between Breeds.
- It allows New Breeders to Contact Established Breeders.

Disadvantages of Show Ring Selection

- Emphasis Is Usually Placed on Traits of Little Economic Importance.
- Clever Fitting and Showmanship Can Mask Defects of Various Kinds.
- Differences Between Exhibited animals are Usually Small.
- Conformation and Production Traits Usually Have Low Genetic Correlations.

Choosing Traits for Selection

Many Factors Enter into the Choice of Traits to Be Selected for. the Following ones are the Most Important.

- The Goal of the Selection Programme.
- The Heritability of the Traits.
- The Economic Value of Improvement in Each Trait.
- The Range in Variation of Each Trait.
- Correlation among the Traits.
- The Cost of the Selection Programme.

A. Selection Goals

Often the Goal of the Selection Programme Makes the Choice of Traits Quite Obvious. the Breeder of the Race Horses Must Select for Speed If He Is to Be Successful and His Choice of Traits are Limited to alternative Ways to Measure Speed. Similarly, the Breeder of Dairy Cattle Generally Sets Out to Breed Cows with Superior Milk Production Characteristics. Thus, His Choice of Traits Is Specified by His Selection Goals.

B. Heritability

Heritability Is Defined to Be the Fraction of the Superiority of Parents Which Is, on the average, Transmitted to their off-Springs. to Explain Heritability in Simpler Words, Heritability Tells Us How Much of the Observable Differences in the animal Is Caused by Genes and How Much Is by Environment.

Heritability for the Same Characteristics May Vary from one Population to another and also May Vary from one Characteristic to another Even in the Same Population. the ability to Recognise the Breeding Values or Transmitting abilities of animals Is Closely associated with Heritability. If the Heritability Is High for a Trait, We Can Proceed Straight Way to adopt a System of Mass Selection of Superior animals, with Little attention to Pedigree information, Collateral Relatives, Progeny Test or inbreeding. If the Genetic Improvement in That Trait Is Low, Genetic Progress May Be Disappointing with Mass Selection and Greater attention Should Be Paid to Pedigree Records, Family information and Use of Progeny Tests.

C. Variability of the Trait

Selection Operates on the Variability in Uniform Expression of the Trait. there Can Be Little Selection Response Sometimes, Because any Selected Groups of Parents Will Not Be Much Better Than Those Not Selected. Some Traits are Much More Valuable Than Others. therefore, the innate Variation of the Traits Should Be Carefully Considered in Choosing Traits for Selection.

Variation Can Be increased by Improving Exotic Types and Sometimes This Can Result in New Combination of Genes Which are Superior to Either Parent Type.

D. Correlated Traits

Sometimes Traits Tend to Be inherited together. these Correlations May arise in Several Ways. The Traits May Be of Different Measures of Some Underlying Trait. for Example. Weight and Height are Both Measures of Body Size. therefore, Taller animals are Usually Heavier and these Two Traits are Said to Be Correlated. If the Same Genes Produce Response in Several Traits. Those Traits Will Be Correlated. This Condition Is Referred to as **Pleiotropy**. Correlated Responses are Common. Selection for increased Milk Yield Produces a Correlated Decrease in the Per Cent of Fat in the Milk of Dairy Cows. Thus. Both Direct and Correlated Responses Result from Selection and Some Correlated Responses are Positive While Others Negative.

Correlated Response May Be advantageous in Selection Programme. for Example, Feed Efficiency Is Expensive to Measure Because It Requires Both Weight Gain and Feed intake on Each individual, Whereas Weight Gain Requires Neither Feed Weight Nor individual Feeding.

In Summary, Definite Goals are Essential for a Successful Selection Programme. the Success in achieving these Goals Depends on the Existence of Genetic Differences. the Degree to Which Phenotype Differences are Heritable and the Correlated Responses in Other Traits. in Comparing the Selection Programme, the Breeder Must Evaluate the Value of the Expected

Response and the Cost of the Programme Relative to the Costs and Responses of alternative Selection Programmes.

3.6 Systems of Breeding

The Ultimate aim of the Breeder Is to Evolve Outstanding and Improved Type of animals Which Can Render Better Service to Man. Selection and System of Breeding Constitute the only tools available to the Breeder for Improvement of animals, Since New Genes Cannot Be Created Though they Can Be Recombined into More Desirable Groupings.

Systems of Breeding Has Been Broadly Divided as

1. Inbreeding: Breeding of the Related animals.
2. Out Breeding or Cross Breeding: Breeding of the Unrelated animals.

Inbreeding: It Is a Mating System in Which individuals Mated are More Closely Related Than the average of the Population from Which they Come. It Means the Mating of Males and Females Which are Related. animals Deemed to Be Related only When they Have one or More ancestors in Common on the First 4-6 Generations of their Pedigree. the intensity of inbreeding Depends Upon the Degree of Relationship. Close inbreeding Denotes Mating of Closely Related individuals Like Dam to Son (Mother X Son) or Sire to Daughter (Father X Daughter) or Full Brothers to Full Sisters.

Inbreeding Makes More Pairs of Genes in the Population Homozygous. Wherever there Is inbreeding, there Will Be one or More Common ancestors from Which, Part of the Gene Samples (Gametes) Have arisen.

Cross Breeding:

It Is the Mating of animals of Different Breeds. Cross Breeding Is Followed for Breeding animals for Milk Production and Meat Production. in India Zebu Breeds of Cows and Nondescript Cows are Crossed with Exotic Breeds Like Holstein Friesian, Brown Swiss and Jersey Bulls or their Semen, to Enhance the Milk Production Potential of the Progeny.

Advantages:

- The Desirable Characters of the Exotic Parent are Transmitted to the Progeny Which the indigenous Parent Does Not Have.
- In India, Cross-Breeding in Cows Is Done by Using the Exotic Bulls and the Progeny inherit the Desirable Characters of the Parent Like High Milk Yield, Early Maturity, Higher Birth Weight of Calves, Better Growth Rates, Better Reproductive Efficiency and indigenous Parents' Characters Like Heat tolerance, Disease Resistance ability to Thrive on Scanty Feeding and Coarse Fodder Etc.
- Imparts the Way to Evolve New Breeds with Desirable Characters. Hybrid Vigour Is Made Use of in the Progeny.
- Results are Seen More Quickly in Characters Like Milk Yield in the Crossbred Progeny.

Disadvantages:

- The Breeding Merit of Cross Breed animals May Be Slightly Reduced.
- Cross Breeding Requires Maintenance of Two or More Pure Breeds in order to Produce the Cross Breeds.

Crossbreeding Is Not for Everyone, and Crossbreeding Will Not Overcome Problems of Poor Management. Nevertheless, a Well-Planned and Well Managed Crossbreeding Program Can Result in Robust Cows with Fewer Calving Difficulties, Fewer Health Problems, Higher Levels of Fertility, and Ultimately Improved Longevity. While Crossbreeding May Have a Detrimental Impact on Some Economic aspects Such as the Value of Male Calves and Cull Cows, the Positive Financial Impact associated with Improvements in Functional Traits Has the Potential to Improve Overall Economic Performance of the Dairy Business.

In General, the Cross Breeds Were Found to Have Higher Birth Weight, Faster Growth Rate, Earlier age at First Calving, Higher Weight; at First Calving, Higher Lactation Yield, Longer Lactation Period) Shorter Service Period, Dry Period and Milk Production and Breeding Efficiency.

There are Several Exotic Breeds Being Used in Cross Breeding Programme, Namely Holstein Friesian, Jersey, Brown Swiss and Red Dane Holstein Friesian Is Found to Be Best Suited for Fluid Milk Supply in Cities, and Where Higher Feed inputs Can Be Provided and Where the Temperature Is Temperate or Sub-Tropical. in Contrast Jersey Crosses are Ideal When the Milk Is Meant for Product Manufacture and Where Feed inputs are Limited and the Climate Is Tropical.

3.7 artificial insemination

Artificial insemination Is the Technique in Which Semen with Living Sperms Is Collected from the Male and introduced into Female Reproductive Tract at Proper Time with the Help of instruments. This Has Been Found to Result in a Normal offspring. in This Process, the Semen Is inseminated into the Female by Placing a Portion of It Either in a Collected or Diluted form into the Cervix or Uterus by Mechanical Methods at the Proper Time and Under Most Hygienic Conditions. Further Studies Under Research Station Conditions Helped This Technique to Be Used Commercially all Over the World including India.

Artificial insemination Is Not Merely a Novel Method of Bringing about Impregnation in Females But a Powerful tool Employed for Livestock Improvement. in artificial insemination the Germplasm of the Bulls of Superior Quality Can Be Effectively Utilized with the Least Regard for their Location in Faraway Places. by adoption of artificial insemination, there Would Be Considerable Reduction in Both Genital and Non-Genital Diseases in the Farm Stock.

Symptoms of Heat in Cows for Performing artificial insemination

- The animal Will Be in Excited Condition. the animal Will Be Restless and Nervous.
- The animal Will Bellow Frequently.
- The animal Will Reduce the intake of Feed.
- Peculiar Movement of Lumbo- Sacral Region Can Be Observed.
- The animals Which are in Heat Will Lick Other animals and Smell Other animals.
- The animals Will Try to Mount Other animals.
- The animals Will Standstill When another animal Tries to Mount. This Period Is Known as Standing Heat. This Extends for14-16 Hours.
- Frequent Micturition (Urination) Will Be Observed.
- Clear Mucous Discharge Will Be Seen from the Vulva, Sometimes It Will Be String Like and the Mucous Will Be Seen Sticking Near the Parts of Vulva.

- Swelling of the Vulva Will Be Seen.
- Congestion and Hyperaemia of Mucous Membrane.
- The Tail Will Be in Raised Position.
- Milk Production Will Be Slightly Decreased.
- On Palpation, Uterus Will Be Turgid and the Cervix Will Be Opened.

Advantages of artificial insemination:

- There Is No Need of Maintenance of Breeding Bull for a Herd thereby Reducing the Cost of Maintenance of Breeding Bull.
- It Prevents the Spread of Certain Diseases and Sterility Due to Genital Diseases.
E.G.: Contagious abortion, Vibriosis.
- Regular Examination of Semen after Collection and Frequent Checking on Fertility Help in Early Detection of inferior Males and assurance of Better Breeding Efficiency.
- The Progeny Testing Can Be Done at an Early age.
- The Semen of a Desired Sire Can Be Used Even after the Death of That Particular Sire.
- The Semen Collected Can Be Taken to the Urban areas or Rural areas for insemination.
- Possibility of the Mating of animals with Great Differences in Size without injury to Either of the animal.
- It Is Helpful to inseminate the animals That Refuse to Stand or accept the Male at the Time of Oestrus.
- It Helps in Maintaining the accurate Breeding and Calving Records.
- It increases the Rate of Conception.
- It Helps in Better Record Keeping.
- Even Old, Heavy and injured Sires Can Be Used for Semen Collection.

Disadvantages of a.i:

Artificial insemination Has Some Potential Drawbacks.

- First, It Can Be More Laborious. Male animals instinctively Detect the Females That are in the Correct Status for Conception. with artificial insemination the Detection Work Falls on the Responsibility of the Farmer.
- Poor Detection Results in Decreased Rates of Fertility. also, increasing the Number of offspring Per Male Has Selective advantages only If the Best Males Can Be accurately Determined. Otherwise This Process only Decreases the Genetic Variability in a Population.
- Increasing the Number of offspring Per Male always Reduces the Gene Pool.
- Ai Requires Well-Trained Operations and Special Equipment.
- Requires More Time Than Natural Services, Necessitates the Knowledge of the Structure and Function of Reproduction on the Part of Operator.
- Improper Cleaning of instruments and insanitary Conditions May Lead to Lower Fertility.
- If the Bull Is Not Properly Tested, the Spreading of Genital Diseases Will Be increased. Some Males Shed Virus in Semen without Clinical Signs of Disease and
- Management Skills are Necessary to Effectively Implement on ai Program.

Timing of insemination for Maximum Conception

When a Heifer Becomes Sexually Mature the Ovaries Begin to Function in a Cycle of activity. This Cycle involves a Sequence of Events in Preparation for Mating, Conception and Pregnancy. the Cycle Repeats in Preparation for a New Mating Cycle If Pregnancy Does Not Occur. the Cycle Has an average Length of 21 Days. any Period Between 18 and 24 Days Is Considered Normal. Cow Ovulates at about 12hrs after End of Oestrus. the Ideal Time of Ovulation Is 6-24 Hrs. Success in insemination Timing Is Dependent Upon a Good Heat Detection Program. Proper Oestrus Detection Is Critical to the Success of ai. approximately 75 to 80% of Cows in Oestrus Will Be Identified When the Herd Is Visually Observed Twice Daily (30 Minutes Each Time). When Oestrus Detection Is increased to Three Times Daily, 85% of Cows in Oestrus May Be Detected, While Four Daily Observations Identify More Than 90% of Cows in Oestrus. Several aides Have Been Developed to Help Producers Detect Oestrus, including Pedometers, Kamar Patches (Heat Detection aid), Tail Paint, Chin-Ball Markers, and Radio Telemetric Systems. a Combination of Visual Observation and one or More of the Detection aides increases the Efficiency of Oestrus Detection Compared to Visual Observation or Detection aides alone.

A Practical Recommendation for Timing of insemination

Cows Showing Oestrus	Should Be inseminated	Too Late for Good Results
In Morning	Same Day	Next Day
In afternoon	Morning of Next Day or Early afternoon	After 3 P.M.

3.8 Package of Practice to Improve Reproductive Efficiency

- Accurate Record Kept Is Very Important in Ensuring Reproductive Efficiency of the Herd.
- Their Production Details Like Date of Oestrus, Date of Service and Calving Should Be Maintained Properly.
- This Data Should Be Used to Predict the Probable Date of Heat, Such animal Should Be Watched Carefully in the Morning and Evening for Signs of Heat.
- In Larger Dairy Farm Teaser Bulls Can Be Put in Use.
- Complete Breeding History, Past Performance and Difficulties of individual Cows Should Be Maintained.
- Irregular Oestrus and abnormal Discharge Should Be attended Immediately.
- The Cows with Retained Placenta Should Be Treated Promptly and When Such Cows are Prepared for Next Breeding, the Reproductive Tract Should Be Examined Thoroughly for involution and Possibility of infection.
- A Manager Should Examine a Cow 24 to 36 Hours after Service for Metestrus Bleeding. If It Occurs Under 24 Hours after Service, It Can Be Concluded That the Cows Were Bred too Late.
If It Occurs Over 36 Hours after Service, It Can Be inferred That they Were Bred too Early During Oestrus. This Will Help in Pinpointing of Failure of Conception.
- Cow Should Be Examined for Pregnancy 45 to 60 Days after Service So That If they are Non-Pregnant, Steps Can Be Taken to Re-Breed them at the Earliest Opportunity.
- If the Conception Rate Under a.I Is Lower Than Natural Service, Time of insemination, insemination Technique and Quality of Semen Must Be Checked.

- Short Irregular Cycles indicate Cystic Ovaries, Short and Long Irregular interval Point to Missed Heat.
- Silent or Quiescent Heat: the Behavioural Manifestation of Heat May Be Very Weak or Imperceptible in Such Case. It Is Very Common in Buffaloes. But there Is a Normal Ovulation and If inseminated at Proper Time the animal May Conceive.
Cows Go Through the Normal Ovarian Changes of the Oestrus Cycle Except the Behavioural Heat and Sexual Receptivity.
It Is More Pronounced in Summer Than in Other Seasons and More in Heifer Than in adult animals.
- Use of Balanced Feed and Proper Summer Management and Use of Teaser Bulls in Detecting Silent Heat Can Be Implemented.

Anoestrus or absence of Sexual Cycle May Be Due to Underdeveloped Genitalia or Due to Persistent CL (Corpus Luteum). in the former Case, Follicles Fail to Develop, and a Heifer Will Not Come to Heat at all. one of the Major Causes of Underdeveloped Genitalia Is Malnutrition. Besides, there Can Be Genetic Causes.

Anoestrus Can Occur Due to Certain Hormonal Disturbances Like the Persistent Corpus Luteum Beyond the Life Expectancy in a Normal Cycle, thereby Preventing Further Cycling. a Common Cause for Persistent CL Is Endometritis of the Uterus. Sometime anoestrus Is often Observed in the Early Post-Partum Period When the Lactation Is Strong, Probably Due to the influence of Lactation (Due to Secretion of Prolactin)

4. DAIRY NUTRITIONAL MANAGEMENT

4.1 Nutritional Requirement of Cows

The High Producing Dairy Cow Requires a Diet That Supplies the Nutrient Needs for High Milk Production. Carbohydrates, amino acids, Fatty acids, Minerals, Vitamins, and Water are all Nutrients Required by the Lactating Dairy Cow to Meet the Demand by the Mammary Gland to Produce Milk and Milk Components. However, in order to Develop the Cow That Will Produce a High Milk Yield, It Begins with the Nutrition of the Calf and Heifer.

Raising Heifers Constitutes 15%–20% of Dairy Farm Expenses and often Is the Second or Third Greatest Cost on the Dairy Farm. Feed Cost Is the Greatest Expense While Labour Is the Second or Third Greatest Expense. therefore, the Goal Is to Raise Healthy Heifers with Optimum Growth, and Reduced Veterinary Expenses. the Optimal age of Calving Has Been Established to Be Between 22 and 24 Months of age. Raising Healthy Calves Begins with Colostrum.

Colostrum

Colostrum Is the First Mammary Secretion Produced by the Mammary Gland of Mammals. It Is Especially Important in Pre-Ruminant animals Like Calves. in the Uterus (In Utero), Calves are Being Nurtured Through a Six-Layered Cotyledonary Placenta, However, Negligible amounts of antibodies (Immunoglobulins) Get Transferred to the Fetus During Gestation. therefore, Immunoglobulins (Ig) Must Be Provided Through the Colostrum Soon after the Calf Is Born. Immunoglobulins are Important in the Health of the Calf as they Provide for the Defense against Various Pathogens and Viruses.

Colostrum Should Be Harvested from the Cow as Soon as Possible after Calving for Several Reasons:

- Colostrum Quality Diminishes Over Time as the Mammary Gland Changes from Colostrum Production (Colostrogenesis) to Milk Synthesis (Lactogenesis).
- As Colostrum Volume increases, IgG Decreases.
- Absorption of Immunoglobulins by the Calf Is Reduced as Time after Calving increases.

Besides increasing Immunity, there are Other Components in Colostrum That Positively affect Gut Health Resulting in increased Health and Overall Performance.

Calf Starter Grain

For the Rumen to Develop, It Is Essential That Calves Consume a Highly Palatable Source of Solid Feed (Calf Starter Grain). This Is Essential Because Rumen Fermentation Must Occur for the Rumen to Develop. Bacteria Which are Present from Transfer Via the Dam and from the Environment Ferment the Solid Feed and Produce Volatile Fatty acids (VFA). the Four Carbon VFA, Butyrate, Is the Most Important for Rumen Epithelial (Papillae) Development. Feeding Starter Is Necessary for This to Occur. Because Grain Ferments at a Faster Rate Than forage, It Is Not Necessary to Feed Hay at This Stage of Life. Typically, Calf Starter Contains Whole or Crimped or Steam-Flaked Grains along with a Pellet. Some Starters are Completely Pelleted and Good Quality Hay Must Be Fed.

Water

Calves Need to Be Fed Free-Choice Water along with Milk or Milk Replacer. Due to a Physiological adaptation, Milk or Milk Replacer Is Shunted Past the Rumen to the abomasum Through the formation of the Esophageal Groove. Water Consumption Does Not Cause This to Occur Unless It Is Fed Immediately after Milk or Milk Replacer Feeding Resulting in the Water Entering the Rumen, This Is Essential for Bacteria to Ferment the Solid Feed and Produce Vfa.

Feeding the Post-Weaned Heifer

To Take advantage of the Growth Realized During the Pre-Weaning Phase It Is Critical to Feed the Post-Weaned Heifer Correctly. Goals to Be Obtained Is to Feed these Heifers So they Weigh about 55% of their Calving Weight at Breeding (13–15 Months) and 82%–85% of Mature Weight at Parturition (22–24 Months). Nutrient Requirements for the Large-Breed Heifer Vary as the Heifer Grows and When She Becomes Pregnant at around 400 Kgs. Typically, these Heifers are Fed a High forage Diet as forages Can Typically Meet these Nutrient Requirements. a Large-Breed Heifer Should Gain 0.87 Kg/D During the Post-Weaning Phase.

Nutrition of the Dairy Cow

Diet formulation for the High Producing Dairy Cow Requires Knowledge of the Nutrients That are Required by the Mammary Gland to Produce Milk. these Nutrients include Water, Protein (Amino acids), Carbohydrates, Fats, Minerals, and Vitamins. Understanding of their Physical Characteristics and their Combined interactions are Essential to Successful Dairy Cattle Feeding.

Water Requirements Mature Dairy Cattle Should Have access to 4 inches of Linear Water Space, But No Less. While This Is a Small Space Per animal, It Is Sufficient Because all Cattle Do Not Drink at one Time If they Have Continual access to Water. Dairy Cattle on Pasture Should Have access to Free-Choice Water at all Times. Failing to Provide adequate Water Will Reduce Production and Result in Feed intake.

Protein and amino acids

Protein Is Typically Measured in Feedstuffs as Crude Protein (Cp) Which Is Defined as the %N(Nitrogen) in a Feed Multiplied by 6.25. the Value 6.25 Is Derived from the Fact That Feed Proteins Contain approximately 16% N. However, Crude Protein Contains Not only True Protein, But Other N Containing Compounds Such as amino acids, Dipeptides, Nucleic acids, $\text{NH}_3 - \text{N}$, and Other Non-Protein Nitrogen (Npn) Compounds. It also Needs to Be Realized Early on That Cattle as with all animals Do Not Have a Protein Requirement, they Have an amino acid Requirement and True Proteins are Defined as Chains of amino acids. Cattle Can Use amino acids for the Production of Enzymes, Milk Proteins, Immunoglobulins, Muscle and Various organs and Tissues in the Body. Excess amino acids Can Be Used in Some instances for Gluconeogenesis and Lipogenesis. the Production of Milk Proteins Is Needed for the Production of Bioactive Proteins Present in the Whey Portion of Milk Which Have Several Protective Functions for the Neonate. the Production of Casein and Whey Protein Provides the amino acids Necessary for Growth in the Young.

Recommendations

Lactating Cows Should Be Fed an array of Protein Sources instead of one Type. for Example, Corn Distillers and Corn Gluten Meal are Both Derived from Corn, therefore Lactation Performance Could Be Improved by adding Soybean and/Or Canola Protein Sources.

Carbohydrates

Carbohydrates are Nutrients Based on Carbon, Hydrogen, and Oxygen. there are More Oxygen Molecules in Carbohydrates Than Lipids. they are also the Largest Component in the Diet of Dairy Cattle. Comprising Up to 70% of the Diet of Lactating Dairy Cattle and More in That of Growing Heifers and Non-Lactating Cows. Carbohydrates are Typically Described as Sugars and Chains of Simple Sugars.

Sources of Carbohydrates include forages, Roughages, Grains, and Sugars. forages including Hay, Hay-Crop Silage, Grain-Based Silage (Corn or Small Grains) are Primarily Digested by Cellulolytic Bacteria Which Result in the Production of acetic and Butyric acid. forages are Typically Fed with adequate Particle Size ($>3/8$ inch) to Provide for Rumination (The Process of Regurgitation of Cud and the Remastication of the forage). This Function Results in the Production of Saliva Which Contains a Buffer to Help Maintain Rumen Ph (Approximately 6.0–6.5). an acidic Environment (Defined as a Prolonged Time Under Ph 6) Results in Lesser Numbers of Bacteria and Poorer Feed Digestibility. If acidic Conditions are Prolonged in the Rumen, Milk Fat Depression Can Occur along with Laminitis Due to Histamine from Dead Ruminal Bacteria toxins Congesting in the Hoof. therefore, Providing adequate forage Can Optimize Rumen Health. Roughages Can Be forages, But Can also include byproducts Such as Hulls from Soybeans and Cottonseeds.

Microbial Fermentation

Microorganisms Which Reside in the forestomach of Ruminants Ferment Carbohydrates to Produce End Products Called Volatile Fatty acids (Vfa). these Vfa are Used as Energy Sources by the Cattle. the Primary Vfa for Cattle are acetic acid, Propionic acid, and Butyric acid. acetic acid (2 Carbons in Length) and Butyric acid (4 Carbons in Length) are Used for Milk Fat Synthesis in the Mammary Gland of the Lactating Cow, While Propionic acid (3 Carbons in Length) Is Primarily Used for Glucose. Glucose Is the Primary Precursor of the Disaccharide Lactose Which Is the Major Osmol-Regulator of Milk. an increase in the Concentration of Lactose Results in an influx of Water into the Mammary Gland Resulting in increased Milk Yield.

Recommendations

It Is Suggested That Most Cows Be Fed Diets Containing Greater Than 50% of the Diet as forages, However, This Can Vary Significantly Depending on the inclusion of Fibrous byproducts. However, there are instances Where More forages Can Result in adequate Production. Heifers and Dry Cows are Fed Diets with a Much Greater Proportion of forages Than Lactating Cows Due to the Lesser Nutrient Requirements of Cattle in these Life-Phases. Producers Need to Strive for the Highest Quality forage as It Dictates the Purchase of Commercial Grains and Supplements. Higher Quality forages (Lesser Ndf) Will Result in Decreasing the Need for Purchased Feeds and Enhance the Farm's Profits.

Fat

Fat Comprises the Most Energy Dense Nutrient with 2.25 Times as Energy Than Carbohydrates or Protein. Fat Is Not appreciably Fermented in the Rumen Resulting in Little Heat of

Fermentation and Can Help Maintain Caloric intake Especially When Cattle are Experiencing Heat-Stress.

How to Feed Fat

It Is Imperative to Remember That almost all Feeds with the Exception of Water and Minerals Contain Fat. Many Lipid-Soluble Vitamins Have Isoprenes as their Carbon Backbones. Carbohydrates Typically are associated with about 3% Fat with Some Immature Grasses Having Over 5% Fat. Protein Meals Tend to also Have around 3% Fat Depending on How they are Processed While Some Distillers and Brewers Grains Can Contain Up to 10% Fat. Oilseeds (Soybeans, Cottonseed, Canola, Flax) Typically Have approximately 20% Fat While Some Lesser-Used Oilseeds (Sunflower, Pumpkin) Can Have Fat Content approaching 45%. Recommendations to Feed Typically indicate Not to Feed More Than 8% of Fat in total Dry Matter. adding an additional Pound of Prilled Fat (Rumen-Inert or bypass Fat) Will Result in a 7.35% Fat Diet and Is Typically Fed to High Producers Near Peak. as Lactation Progresses and Milk Production Begins to Drop, It Is Common to Remove the inert Fat and as a Cow Enters Late Lactation, the Oilseeds Will Typically Be Removed from the Diet. It Is Recommended That Calcium Level Be increased in the Diet When Feeding Fat to 1% of Diet Dry Matter to Reduce any Deleterious Effects on Rumen Fermentation.

What to Expect

If Fat Is Fed Correctly, Early Lactation Cows Should See Higher Milk Yields, Sometimes Enhanced Milk Fat Content, But almost always a Reduced Milk Protein Concentration. However, there May Be an increase in Milk Protein Yield (Kg) Due to the increased Milk Yield. Cows Post-Peak Should See an increase in Body Condition. Cows Should also Experience Improved Fertility Through Either Greater Energy Balance or Improved Hormone Concentrations involved in Reproduction.

Minerals

Minerals are Typically Classified as Metal Elements That are inorganic Compounds Required for Many Different Bodily Functions from Structure, and Nerve Impulses to Osmotic Balance. Some Minerals Serve as Catalysts for Reactions or are Necessary for Enzyme Function (E.G. Glutathione Peroxidase).

Minerals are Divided into Two Categories

- 1) Macrominerals (Including Ca, P, Mg, K, Cl, Na, and S) Which are Required in Gram Quantities.
- 2) Microminerals also Known as Trace Minerals are Required in Mg or Mg Quantities.

In Dairy Cattle, Mineral Nutrition Is Essential for the Success of the Lactation. Because of the Large amount of Milk That Cows Produce at Parturition, there Is a Large Draw on Calcium. often This Situation Will Put the Cow into a Hypocalcaemic State, Commonly Known as Milk Fever or Parturient Paresis. in This State, the Cow Will Have an inability to Stand, Will Have Cold Ears, and Will often Have a Reduced Body Temperature. Macrominerals to Consider When formulating Dairy Cow Diets

Calcium

Besides Structure and Feed Prehension, Ca Is Needed for Smooth Muscle Function and Nerve Impulse. Cows That Experience Hypocalcemia Can also Experience Retained Placenta Due to

the inability for the Uterus to Contract to Release It. Mastitis Can also Occur as the Keratin Plug (An antibacterial Physical Barrier Present in the Streak Canal) Falls Out Due to the Relaxation of the Muscles within the Teat End. This Results in the ability for Bacteria to Enter the Teat Cistern and Gland Cistern of the Hypocalcaemic Cow. Other Disorders Can Occur Such as Ketosis Due to Reduced Gastrointestinal Tract Motility and Low Caloric intake. Good Sources of Ca include Green forages and Limestone.

Phosphorus

Phosphorus Is Present in Every Cell within the Body and almost all Energy-Dependent Reactions involve the formation of Breaking High Energy Phosphate Bonds (Adenosine Triphosphate). Phosphorus Deficiency Is Very General and Can Be Duplicated for Many Other Minerals. these include Poor appetite, Poor Growth, Reduced Fertility, and Typically Poor Overall Performance.

Potassium

Potassium Is the Third Most abundant Mineral in the Body. Potassium Is involved in acid-Base Regulation, Water Balance, Nerve Transmission, Muscle Contractions, Oxygen and Carbon Dioxide Transport and a Co-Factor in Many Enzymatic Reactions. Lactating Dairy Cows Should Be Fed a Diet Containing 1.5% K or More, While Calves Need 0.4%–0.55%. However, Lower K Can Be Beneficial in Dry Cow Diets as a Means of Reducing Hypocalcemia.

Magnesium

Magnesium Is an intracellular Cation Required for Many Enzymatic Reactions. in Cows, absorption of Mg Primarily Occurs in the forestomach, While in the Small intestine in Young Calves. forages Have adequate Mg, But absorption Requires Na(Sodium). So, Feeding Na Is Necessary for Mg Uptake. Deficiency Can Occur When Pastures and Feeds Contain High amounts of K. therefore, Supplemental Mg Is Needed Especially When High-Quality Pasture and forages are Fed.

Sodium

Sodium Is Primarily an Extracellular Cation and Can Improve animal Performance. It Is Commonly Fed as Salt and as a Rumen Buffer. the Requirements of Na are Highly Variable and Is about 0.24% of the Diet. Salt Deficiency Results in Pica and Usually Takes 2–3 Weeks to Occur. a Sign of Salt Deficiency Is the Consumption of Urine by Deficient Cows. Salt toxicity Can Occur If inadequate Fresh Drinking Water Is absent, with Udder Edema and Eventual Collapse Will Occur.

Chloride

Chloride Is the Major anion Making Up to 60% of the anions in Extracellular Fluid. It Has a Strong Relationship with K and Na. It Is Essential for the Transport of Oxygen and Carbon Dioxide. a Deficiency of Cl Results in Metabolic alkalosis, Fecal Mucus, and Polyuria.

Sulfur

Sulfur Is Found in amino acids Such as Methionine, Cysteine, and Taurine. the Requirement of S Is 0.2% of the Diet (Dry Matter Basis). Sulfur Is also Present in Thiamin, Biotin and Chondroitin Sulfate.

Microminerals to Consider When Formulating Dairy Cow Diets

Copper

Copper Requirements are Low, a Lactating Cow Requires 0.15 Mg/Kg of Milk. It Is only absorbed at 1%–5% in adult Cattle, But 70% in Newborns. Copper Is Usually Fed as a Sulfate, But Copper Chelated to a Protein increases Cu absorption. a Deficiency of Cu Is Very Distinct with a Loss of Coat Pigment Especially around the Eyes Resulting in “Spectacle Eyes”.

Iodine

Iodine Is Necessary for the Production of the Hormones Triiodothyronine and Thyroxin Both involved in Metabolism and Produced in the Thyroid Gland. the Requirement of Iodine Is at Maintenance 0.6 Mg/100 Kg of Body Weight. This increases to 1.5 Mg/100 Kg of Body Weight During Lactation Due to Thyroxin Production.

Iron

A Preruminant Calf Needs about 150 Mg/Kg of Dm While a Mature Cow only Needs 24 Mg/Kg of Dm. a Deficiency of Fe Is Very Rare But Can Be Found in Calves as Microcytic anemia Due to the Failure to Produce Hemoglobin. This Deficiency Is Very Rare in adult Cattle Suggesting That the Fe in forages Might Be adequate.

Manganese

The Mn Requirement Is 40 Mg/Kg of Diet Dry Matter. toxicity Results in Silent Heats and Low Conception Rates. Deficiency Can also Cause the Same Effects on Fertility as toxicity, But also Skeletal abnormalities.

Zinc

The Requirement in the Growing Heifer Is 200–300 Mg and 22.8 Mg/Kg of Diet (On a Dm Basis) in a Cow. about 50% of Zn in Milk Gets absorbed by Calves. Deficiency of Zn Results in Weak Hooves, Impaired Testicular Growth, and Parakeratosis (Scaly Skin).

Selenium

This Enzyme Is Responsible for the Conversion of Cell-Damaging Hydrogen Peroxide to Water. White Muscle Disease (WMD) Is the Common Deficiency Sign with Leg Weakness, Stiffness, and Muscles Have Chalky Striations. Calves with WMD Usually Die of Cardiac Failure.

Vitamins

Vitamins are Needed for Metabolism. they are organic Compounds That Can Be Divided into Two Categories, Water-Soluble and Lipid Soluble. Water-Soluble Vitamins are Those That Go into Solution within an aqueous Environment. they are Typically Synthesized at adequate Quantities within the Rumen. However, there are Some Water-Soluble Vitamins That When Supplemented Can Have Beneficial Effects. Lipid-Soluble Vitamins are Those Which are Lipid-Based. they are Vitamins a, D, E, and K. Vitamin K Is involved in Blood Clotting and Is Synthesized by the Rumen Microbes at adequate Quantities. Vitamin a, D, and E Need Various Levels of Supplementation Depending on the Diet Fed.

Feed additives

Feed additives are Typically added to Dairy Cattle Diets to Improve Performance Such as Growth, Milk Yield, Milk Component Yield, Feed Efficiency, and Health. their Use Should Be

Based on Unbiased Research and their Return on investment. This Section Will Describe Some Common Feed additives and their Potential Response.

Ionophores

Ionophores Have Been Fed to Dairy Cattle for Many Decades Resulting in Improved Feed Efficiency, Reduced Coccidiosis in Calves and Heifers, and Reduced incidence of Ketosis in Lactating Cows. there Probably Have Been More Research Evaluating Ionophores in Ruminant Diets Than any Other Feed additive. they are Classified as antibiotics and are Produced from the End-Products of Bacterial Fermentation by Two Bacteria, *Streptomyces Cinnamomensis* (Monensin) and *S. Lasaliensis* (Lasalocid). they are active in the Rumen by Reducing the Numbers of Gram-Positive Bacteria and thereby Enhancing the Numbers of Gram-Negative Bacteria Causing an increase in the Production of Propionate. This Volatile Fatty acid Is Primarily Used by Ruminants as the Precursor of Glucose. Heifers That are Fed Ionophores Have Improved Growth Efficiency (Gain/Feed). Lactating Cows Fed Monensin are Less Prone to Ketosis Due to the Presence of More Propionate and Ketosis Is Essentially a Deficiency of Glucose. Ionophores Disrupt the Cell Membrane of Gram-Positive Bacteria Resulting in their Death. they also Work Similarly against Coccidia in the intestine of Calves and Heifers and aid in the Reduction of This Protozoal Disease.

Probiotics

There are Presently Many Different Probiotics including Bacterial Species, Yeasts, and Yeast Cultures. these Products are Thought to Enhance Nutrient Digestibility Through increasing Bacterial Species. Some Probiotics Can Have Positive Effects in Young Calves by Stimulating Local Immunity in the Small intestine.

Rumen Buffers

Another Common Feed additive Found on Many Dairy Farms Especially in Lactating Cow Rations Is Sodium Bicarbonate (Baking Soda). Sodium Bicarbonate Is Thought to increase the Ph of the Rumen, But It Is also involved in Enhancing Water intake Resulting in a Greater Rate of Passage and More Feed intake.

Sodium Butyrate

Recent Research Has Shown That Sodium Butyrate added to Calf Starter Grain Can Benefit Young Calves apparently Through Enhanced Rumen Papillae Development. Sodium Butyrate Is involved in Epithelial Development in Many Species. It appears That adding It to Milk Replacer Enhances intestinal Development While adding It to Post-Weaned Heifer Diets Enhances Feed Efficiency.

Essential Oils

With the Recent Regulation in the Use of antibiotics, Researchers Have Evaluated Other Feed additives That May Serve in Enhancing Feed Efficiency in Dairy Cattle. these Oils are Extracts from Different Plants. the Responses are Mixed and Currently are Not Recommended to Be Fed to Dairy Cattle.

4.2 Classification of Feedstuffs

Concentrates

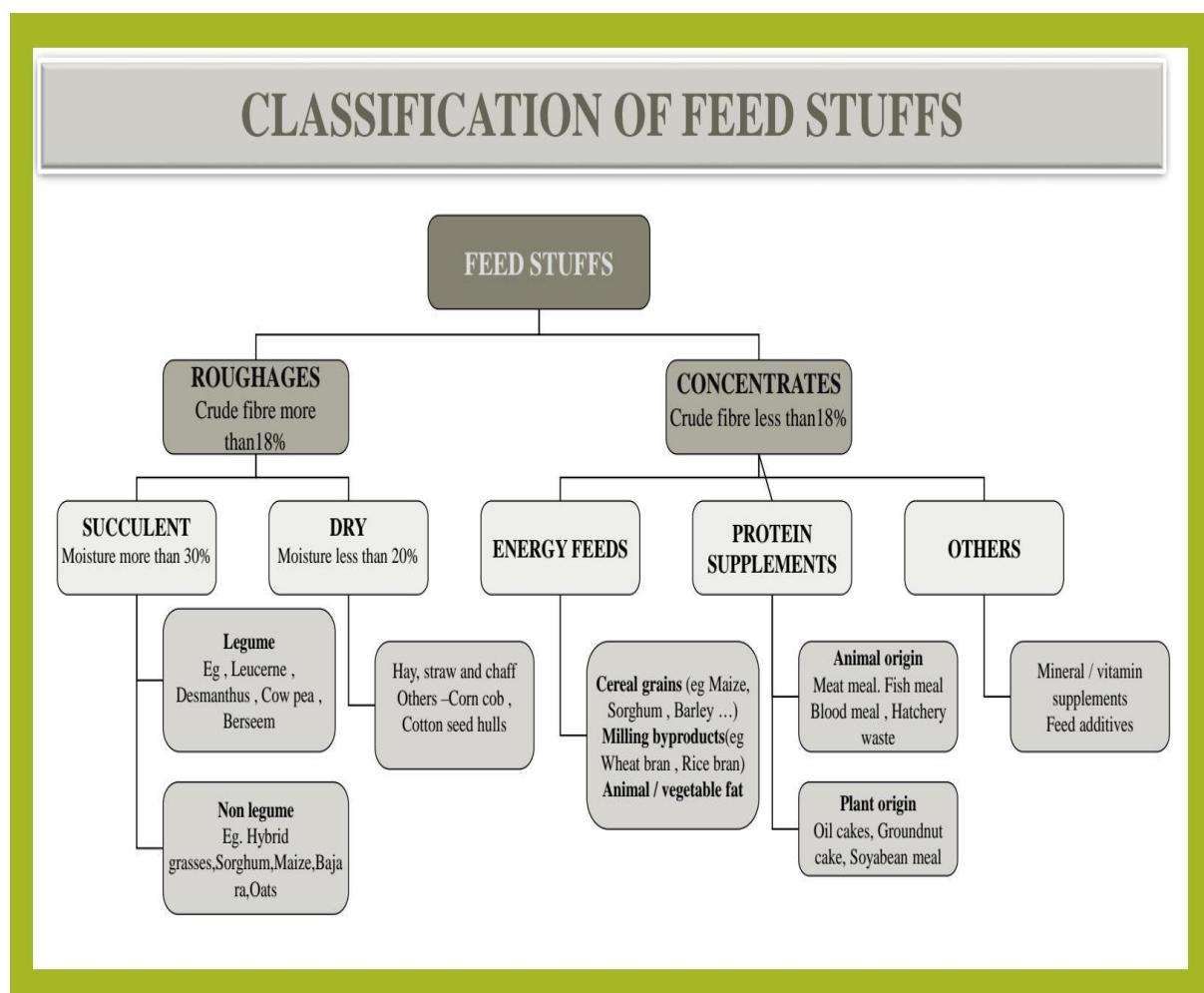
A Concentrate Is Usually Described as a Feed or Feed Mixture Which Supplies Primary Nutrients (Protein, Carbohydrate and Fat) at Higher Level But Contains Less Than 18% Crude Fibre (Cf) With Low Moisture. In General, Concentrates are Feeds That are High in Nitrogen Free Extract (Nfe) and total Digestible Nutrients (Tdn) and Low in Crude Fibre.

On the Basis of the Crude Protein Content of air-Dry Concentrates, these are Classified as Either Energy Rich Concentrates When Crude Protein (Cp) Is Less Than 18% or Protein Rich Concentrates When the Cp Value Exceeds 18%.

Energy Sources

These are Described Under the Following Categories:

- Grains and Seeds
- Milling by-Products
- Molasses
- Roots and Tubers
- Grains and Seeds



Protein Sources

Ingredients That Contain More Than 18% of their total Weight in Crude Protein are Generally Classified as Protein Feeds. Protein Is one of the Critical Nutrients Particularly for the Young

Rapidly Growing animal and High Producing adults, although, It May Be Secondary to Energy or Other Nutrients at Times. in addition, Protein Supplements are Usually More Expensive Than Energy Feeds, So Optimal Use Is a Must for any Practical Feeding System. Protein Supplements May Be Further Categorized according to Source of origin as I) Plant Protein ii) animal Protein iii) Non-Protein Nitrogen and iv) Single Cell Protein.

4.3 Roughages

Roughages are Bulky Feeds Containing Relatively Less Digestible Material i.e., Crude Fibre More Than 18% and Low (About 60%) in Tdn on air Dry Basis. Most of Roughages Have a High Content of Cell Wall Material. the Cell Wall Fraction May Have Highly Variable Hemicellulose, Pectin, Polyuronides, Silica and Other Components. in Contrast to Cereal Grains, Roughages Generally are Low in Readily available Carbohydrates. the amount of Lignin Is a Critical Factor with Respect to Digestibility. Lignin Is an amorphous Material Which Is associated Closely with the Fibrous Carbohydrates of the Cell Wall of Plant Tissue. It Limits Fibre Digestibility, Probably Because of the Physical Barrier Between Digestive Enzymes and the Carbohydrate in Question.

The Protein, Mineral and Vitamin Contents of Roughages are Highly Variable. Legumes May Have 20% or More Crude Protein Content, although a Most of May Be in the form of Non-Protein Nitrogen (Npn). Other Roughages, Such as Straw May Have only 3-4% Crude Protein, Most Others Fall Between these Two Extremes. Mineral Content May Be Exceedingly Variable; Some Roughages are Relatively Good Sources of Calcium and Magnesium, Particularly Legumes.

Roughages are Sub-Divided into Two Major Groups; Dry and Green or Succulent Roughages Based Upon the Moisture Content. Green Roughages Usually Contain Moisture from 60- 90%, Whereas, Dry Roughages Contain only 10-15% Moisture. for the Sake of Convenience, Succulent Feeds are again Classified into Various Types Such as Pasture, Cultivated Fodder Crops, Tree Leaves, Roots and Crops. Dry Roughages Have Been Further Classified as Hay and Straw, Based on the Nutritive Values and Methods of Preparation.

- Feed alone Constitute 60 Per Cent of the Production Cost of Milk. Hence, Feeding Management Play a Vital Role in Farm Economy.
- The Nutrient Requirement Should Be Determined for Maintenance as Well as for Milk Production and to Meet the Fat Percentage in Milk and Gestation.
- Based on the Nutrient Requirement Ration Should Be Computed.
- In General, the Dry Matter from Roughage Should Not Exceed 2 Per Cent of Cow's Live Weight Nor Should It Be Less Than 1 Per Cent

Tips for Feeding Dairy Cattle

- Concentrate Must Be Fed individually according to Production Requirements.
- Good Quality Roughage Saves Concentrates. approximately 20 Kg of Grasses (Guinea, Napier, Etc.) or 6-8 Kg Legume Fodder (Cowpea, Lucerne) Can Replace 1 Kg of Concentrate Mixture (0.14-0.16 Kg of Dcp) in Terms of Protein Content.

- 1kg Straw Can Replace 4-5 Kg of Grass on Dry Matter Basis. in This Case the Deficiency of Protein and Other Nutrients Should Be Compensated by a Suitable Concentrate Mixture.
- Regularity in Feeding Is Essential. Concentrate Mixture Can Be Fed at or Preferably Before Milking – Half in the Morning and the Other Half in the Evening – Before the Two Milkings. Half the Roughage Ration Can Be Fed in the forenoon after Watering and Cleaning the animals. the Other Half Is Fed in the Evening, after Milking and Watering. High Yielding animals May Be Fed Three Times a Day (Both Roughage and Concentrate). increasing the Frequency of Concentrate Feeding Will Help Maintain Normal Rumen Motility and Optimum Milk Fat Levels.
- Over-Feeding Concentrates May Result in off- Feed and indigestion.
- Abrupt Change in the Feed Should Be avoided.
- Grains Should Be Ground to Medium Degree of Fineness Before Being Fed to Cattle.
- Long and Thick-Stemmed Fodders Such as Napier May Be Chopped and Fed.
- Highly Moist and Tender Grasses May Be Wilted or Mixed with Straw Before Feeding. Legume Fodders May Be Mixed with Straw or Other Grasses to Prevent the Occurrence of Bloat and indigestion.
- Silage and Other Feeds, Which May Impart Flavour to Milk, May Be Fed after Milking. Concentrate Mixture in the form of Mash May Be Moistened with Water and Fed Immediately. Pellets Can Be Fed as Such.
- All Feeds Must Be Stored Properly in Well-Ventilated and Dry Places. Mouldy or Otherwise Damaged Feed Should Not Be Fed.
- For High Yielding animals, the Optimum Concentrate Roughage Ratio on Dry Matter Basis Should Be 60:40.

Table. Nutrients Required for Maintenance of adult Cattle Per Head Per Day (Growth Rate- 550g Per Day)

Live Weight (Kg)	Dry Matter (Kg)	Digestible Crude Protein (G)	Total Digestible Nutrients (Kg)	Calcium (G)	Phosphorus (G)
250	4-5	140	2.2	25	17
300	5-6	168	2.65	25	17
350	6-7	195	3.10	25	17
400	7-8	223	3.55	28	20
450	8-9	250	4.00	31	23
500	9-10	278	4.45	31	23
550	10-11	310	4.90	31	23
600	11-12	336	5.35	31	23

Straw Can form the Roughage in the absence of Grasses and in Such Cases, Concentrates Should Be Given for Maintenance. for Lactating Cows, 1kg of Concentrate Mixture (Compounded Feed) (0.14-0.16 Kg Dcp and 0.70 Kg Tdn) May Be Required for Every 2.5 – 3.0 Kg of Milk Over and above the Maintenance allowance. after Parturition, the Cow Should Be

Given the Same Type of Feed and the Same Quantity as Before and the Concentrate allowance Should Be only Gradually increased to avoid Digestive Disturbances Like acidosis, indigestion, Etc.

In Young Cross-Bred Cows Below Four Years of age, to Meet the Requirements for Growth, It Is Desirable to Give additional Concentrate allowance at the Rate of 1kg for animals in First Lactation and 0.5kg in the Second Lactation Over and above the Maintenance and Production Requirements. Milking animals Should always Have Free access to Clean Fresh Drinking Water.

Feeding Management of Cattle and Buffalo

Table: Feeding allowances for Dairy Cattle

Type of Cattle	Stage of the Cattle	Green Fodder (Kg/Day/Animal)	Dry Fodder (Kg/Day/Animal)	Concentrates (Kg/Day/Animal)
Cow (Average Wt 250 Kg)	Milk Yield 5 Litres/ Day	15	5.0	2.0
	Milk Yield 5 to 10 Litres/Day	17.5	5.5	3.0
	Milk Yield 10 to 15 Litres/Day	20.0	6.0	4.0
Cow in Gestation	-	15.0	5.0	1.5
Bull (Average Weight 300 Kg)	During Days of Work	20.0	7.0	2.0
	During Days of No Work	15.0	5.5	1.0

Feeding of Growing animals (From 6 Months onwards)

For Calves Below one Year of age It Is always Desirable to Give Sufficient Concentrates in addition to Good Roughage So That they Reach Optimum Growth. Feeding Concentrate Can Be Considerably Reduced in the Case of Calves Over one Year of age Fed on High Quality Roughage. a Judicious Mixture of Roughage and Concentrate Is Essential for Obtaining Optimum Growth without Undue Fat Deposition. from Six Months onwards, Calves Can Be Given the Same Type of Concentrate Mixture (14-16% Digestible Crude Protein and about 70% total Digestible Nutrients) as Used for adult Cattle.

Table. Feeding Schedule of Growing animals from 6 Months onwards

Age (Months)	Approximate Body Weight (Kg)	Concentrate Mixture (Kg)	Grass (Kg)
6-9	70-100	1.5-1.75	5-10
9-15	100-150	1.75-2.25	10-15
15-20	150-200	2.25-2.50	15-20
Above 20	200-300	2.50-2.75	15-20

Table. Recommended Concentrate Mixtures (Approx. 15% Dcp about 70% Tdn)

S. No	Ingredients	Parts (Kg)	S. No	Ingredients	Parts (Kg)
1.	Groundnut Cake	32	4	Gingelly Cake	20

	Gingelly Oil Cake	5		Coconut Cake	15
	Rice Bran	25		Yellow Maize	32
	Dried Tapioca Chips	35		Wheat Bran	30
	Mineral Mixture	2		Mineral Mixture	2
	Salt	1		Salt	1
2.	Coconut Cake or Cotton	30	5.	Sunflower Cake(Decorticated)	25
	Seed Cake	10		Cotton Seed Cake(Decorticated)	15
	Rice Bran	30		Jowar	25
	Yellow Maize	27		Wheat Bran	32
	Mineral Mixture	2		Mineral Mixture	2
	Salt	1		Salt	1
3.	Groundnut Cake	33	6.	Groundnut Cake	20
	Rice Bran	30		Rubber Seed Cake	20
	Tamarind Seed(Decorticated)	10		Yellow Maize	27
	Dried Tapioca Chips	24		Wheat Bran	15
	Mineral Mixture	2		Tapioca Starch Waste	15
	Salt	1		Mineral Mixture 2	2
				Salt	1

Feeding of Lactating Cow

- Proper Feeding of Dairy Cattle Should Envisage Minimum Wastage of Nutrients and Maximum Returns in Terms of Milk Produced.
- A Concentrate Mixture Made Up of Protein Supplements Such as Oil Cakes, Energy Sources Such as Cereal Grains (Maize, Jowar), Tapioca Chips and Laxative Feeds Such as Brans (Rice Bran, Wheat Bran, Gram Husk) Is Generally Used.
- Mineral Mixture Containing Major and all the Trace Elements Should Be included at a Level of 2 Percent.

Table. Feeding Schedule for Different Classes of adult Cows (Approx. Body Weight-250 Kg)

When Green Grass Is Plenty			When Paddy Straw Is the Major Roughage		
Category	Concentrate Mixture (Kg)	Green Grass (Kg)	Concentrate Mixture (Kg)	Green Grass (Kg)	Paddy Straw (Kg)
Dry Cows	-	25 – 30	1.25	5.0	5 – 6
Milking	1 Kg for Every 2.5 - 3.0 Kg of Milk	30	1.25 + 1 Kg for Every 2.5 - 3.0 Kg of Milk	5.0	5 – 6
Pregnant	Production allowance + 1 to 1.5 Kg from 6th Month of Pregnancy	25 – 30	Maintenance + Production + 1 to 1.5 Kg from 6th Month of Pregnancy	5.0	5 - 6

The total Dry Matter Requirement of Cattle Is around 2-3 % of their Body Weight Though High Yielding animals May Eat at a Rate More Than 3%. Such Factors as Climate, Processing of Feeds, Palatability Etc. influence the Dry Matter Consumption. Good Quality Grasses (Guinea, Napier Etc.) with a Minimum of 6 % Crude Protein on Dry Matter Basis alone Can form

Maintenance Ration of a Cow of average Size. But It Is Possible to Maintain Milk Production of Up to 3-4 Kg with Grass- Legume Fodder.

4.4 Tmr-Importance

Providing Balanced Nutrition Every Time to the Different Groups of Dairy Cows, Having Different Production Levels Is one of the Many Challenges That a Commercial Dairy Farmer Faces. Production Performance of Dairy Cows Varies as Per Type of Feed Provided. Providing Balance Nutrition to Dairy animals Is an Important Task to Optimise Productivity Both in Milk Production and Reproduction and to Minimize the Cost of Feed. Dairy Cow Rations Must Contain Good Quality forages, a Balance of Grains and Protein Sources Plus Minerals and Vitamins and Other Feed Supplements. to avoid Under or Over Nutrients Feeding animal Must Be Fed Right amount and Right Combinations of Various Feed Stuffs. When Rations are formulated or Balanced Correctly to Meet the Nutrient Requirements of a Cows, It Result in Optimum Feed Digestion and Utilization. there Is a Need to Change the Traditional Feeding Systems with a total Mixed Ration (Tmr) Feeding System, Which Contains Required Feeds and Required Nutrients. This Is an Effective and Profitable Way to Feed Dairy Cows. Every Mouthful of Tmr That a Cow Eats Provides a Balanced Ration.

The Benefit of a Tmr includes

- Less Feed Selection by the Cow,
- Synchronization of Carbohydrate and
- Protein availability in the Rumen, and Lower Rumen acidity.

Tmr May Save Labour Required for Feeding Cows and It Facilitates Feeding Various Types of Feeds. the Main Disadvantage of a Tmr Is the inability to Feed Cows as individual Nutrient Requirement. However, Larger Dairy Farms with More Groups of Cows are able to Minimize This Problem. Tmr Feeding System Facilitates a Nutritionally Balanced Ration at all Times and allowing Cows to Consume as Close to Energy Requirements as Possible as Well Maintaining Physical form of Roughage Characteristics Required for Proper Rumen Function Thus Helps in achieving Optimum Production Economically.

What Is Tmr?

A total Mixed Ration (Tmr) Is a Method of Feeding Cows That Complete Mixture of all forages, Grains, Protein Feeds, Minerals, Vitamins and Feed additives formulated to a Specified Nutrient Concentration into a Single Feed Mix. This Is an Excellent Concept to Improve the Dry Matter intake and Maintain Healthy Rumen Environment. the Knowledge and Use of Tmr System are Necessary Before Its Implementation.

Why Feed a Tmr?

- Tmr Feeding to Cows Provide the Nutrient Balanced Ration in Every Bite or Mouthful When Consumes. This Overcomes the Limitation of Depressed Dry Matter intake (Dmi) During Transitional Period and Helps in Prevention Metabolic Disorders.
- Selective Feeding of Feeds by animals Is Minimized and Cows Eat a Predetermined amount of forages and Concentrates Required for Optimum Production and Health.
- increase in Feed Utilization (4%) Can Be Expected When Using a Tmr Compared to a Conventional Ration of forage and Grain Fed Separately, Twice Daily.
- Farmers Can also Utilize a Greater Variety of Food industrial byproduct as Part of Tmr and Save the Cost of Feeding.

- Providing a Uniform Supply of Protein and Carbohydrates to the Rumen Bacteria Throughout the Day Enhances Rumen Fermentation and the Production of Rumen Bacteria.
- total Mixed Ration (Tmr) Can Reduce the Labour Costs at Medium and Large Dairy Farms thereby increasing Profitability of the Dairy Farm.
- Tmr Provides More Control and accuracy of the Feed amounts Fed Than When Feeds are Fed as Separate ingredients.
- Feeding Tmr Correctly Balanced to Nutrient Specifications Can increase Milk Production Up to 4 to 5%.
- Milk Composition also Improves Because of the Better Rumen Fermentation and Balance of Nutrients Being Consumed by Cows Through Balanced Tmr.
- one of the Major advantages of Blending all the Feeds together in a Tmr Is That It Can Mask the Flavour of Less Palatable Feeds and Can Be Successfully Fed and Better Utilized by the Cow When Fed in a Tmr Rather Than When Fed as individual Separate Feeds.
- with the Use of Tmr Mixers, the Daily Feed intake of Cows Is Easier to Measure. by Knowing Daily Feed or Dry Matter intakes, the Correct amounts of Feed and Nutrients Can Be Fed Minimizing Wastage and Reducing the Cost of Feeding.
- the Tmr System Is Well adapted to Mechanization with a Mixer Wagon or a Stationary Mixer with Conveyors or Mobile Feeders.

Limitations of Feeding a Tmr

- individual Cow Feeding attention Is Not Possible with a Tmr Feeding System Because all Cows in the Group Get the Same Ration.
- Unfortunately, on Farms without the Facilities for Many Groups, Cows are often too Fat or too Thin. This Is Evidence That Some Cows Got too Much Grain and Others Didn't Get Enough. This Is Especially True on Farms with only one Milking Ration (One-Group Tmr).
- Mixing or Blending Devices Needed for the Ration Require Small to Moderate Expenditures for Equipment and Maintenance.
- Dry forages Such as Hay or Straw are Not Mixed Very Well in Some Tmr Mixers. additional Equipment Is Needed to Chop the Hay or Straw Before Being added to the Mixer.
- Care Must Be Taken in formulating and Mixing the Ration. If the Diet Is Not Balanced Correctly or Mixed Properly, the Cow Ultimately Will Suffer Reduced Performance. While This Is True of any Feeding System, It Is Under the Control of the Person Feeding the Herd. Remember with a True Tmr, Cows Have No Other Option for a Diet and Depend Solely on the Ration for a Balanced Diet to achieve Production and Health.
- Dairy Farms Need to Group Cows to Effectively Utilize Tmr Feeding. Cows are Fed as a Group and Cows in the Group Should Be as Uniform in Milk Production and Body Weight as Possible. Large Variations in Milk Productions (Over 10 Kg/ Day) or Body Weights (Over 100 Kg) of Cows in a Group Can Result in Some Cows Being Over or Under Fed increasing Feed Costs and/Or Loss of Milk Production.
- initial Capital investment on Tmr Machine Is More Than Traditional Feeding System.

How to formulate the Tmr Feed? Rations for Dairy Cows are formulated on a Dry Matter Basis and then the amounts of Each Feed are on as Fed Basis. Knowing the Correct Dry Matter of Ensiled forages, and all Other Wet Grains and Feeds Fed in the Tmr Is Critical to the Mixing. Rations Should Be Balanced for Slightly Higher Nutrient intake Than What the average Milk Production of the Group Is. the Dry Matter intake Used to formulate the Ration to the Desired Nutrient Concentrations Should Be the Same as the actual Dm intake of the Group. a General Guide for Lactating Cows Rations Is to formulate them for Milk Productions about 20% above

the average Production of the Group. by formulating Rations Slightly above the average Milk Production, Cows are Challenged to Produce More and If they Do Not, the Extra Nutrition Generally Can Be Used for Growth or added Body Condition. First Lactation Cows Group Ration Can Be formulated for 25% above actual Milk Production of the Group to Provide Nutrients for Growth of these Cows. Key Point Before the formulation of Tmr 1. Determine average Body Weight, Milk Production, and Fat Test of the Group. Determine the Realistic, Desired amount of Milk Production to Balance the Ration. 2. Estimate Dry Matter intake (Dmi) and Determine the amounts of individual forages to Be Fed on a Dry Matter Basis (Based on Quality and inventory). 3. Work Out the Quantity of Grain and Mineral Supplements Required to Meet the Nutrient Needs of the Cow Beyond the Nutrients Supplied by forages. 4. Know the Correct Number of Cows in the Group Every Day and Feed for That Number. Daily Counts of the Number of Cows in a Group Before Feeding Is Necessary So the Correct amount of Feed Fed Per Cow Is Provided. 5. Cow Diet Is Based on forages, Protein, Liquid, Energy, and Vitamins. Farmers Should Calculate How Much of Each Nutrient Cows Need and formulate Tmr according to them.

Table: Protein Requirement of Different Group of Cows for Tmr Feeding System (Based on Nutrient Requirements of Cattle and Buffalo)

For Lactating dairy cows			
	Body weight (Kg)	Milk production (Kg/day)	DMI (Kg/day)
1	300	10 to 15	11.4-13.9
		15 to 20	13.9-16.4
		20 to 25	16.4-18.9
2	400	10 to 15	13.6-16.1
		15 to 20	16.1-18.6
		20 to 25	18.6-21.1
3	500	10 to 15	15.8-18.3
		15 to 20	18.3-20.8
		20 to 25	20.8-23.8
For pregnant cows (8-9 month)			
	Body weight (Kg)	DMI (Kg/day)	Required CP (%) in Formulated TMR(DM basis)
4	300	7.6	8.06
5	400	9.7	7.15
6	500	11.9	6.52

Table: Guideline for Limits (Maximum and Minimum Quantities) of Various Feed ingredient for Making total Mixed Ration

Ingredient used	Quantity of ingredient (kg/day/cow)
Hay/wheat straw	4-6 kg
Maize Silage (DM-35%)	10-12 kg
Maize grain	4-5 kg
Deoiled rice bran	0.2-0.3 kg
Cotton seed cake	3-5 kg
Soymeal	1-2 kg
Mineral mixture (preferably 'Kalvimin Gold')	50-100 g
Salt	40-60 g
Vitamin E	1500-3000 IU
Yeast	5-10 g
Buffer	50-60 g
Bypass fat	200-400g (mostly for high milk producing cows)

Grouping of Dairy Cows for Feeding Tmr

Pre-Partum: (2-3 Weeks Before Calving Up to Calving Day): these Cows Have Low Dry Matter intakes (10.5/ Day Kg) for Large Breeds) But increased Protein and Energy Requirements. the Goal Is to Supply the Needed Nutrients and to adjust the Rumen Microbes and the Rumen Papillae. the Diet Should Contain 32 to 34% Nfc (Usually (3-3.5 Kg) of Grain) Plus Long, Effective Fibre. the Mineral Balance of This Ration Is also Critical for avoiding Milk Fever. Ration Palatability Is also Important.

Early Lactation: (0-30 Days in Milk): these Cows Have Lower intakes But High Nutrient Requirements. a Primary Goal Is to Provide the Nutrients Needed to Drive the Cow towards High Peak Milk Production. often Fresh Cows' Rations are formulated with a Slightly Higher Level of forage Ndf Than the Mid-Lactation Group Ration. additives Such as Calcium Propionate, Niacin and Rumen Protected Choline are often added to Fresh Cows' Rations.

Mid-Lactation: (30-150 Days in Milk): Most of these Cows Should Be Near Peak Feed intake and Peak Milk Production. the Goal Is to Maintain High Milk Production and to Get Cows Bred Back at This Time. Close attention Should Be Paid to Maintain adequate Effective Fibre in This Ration That Is Balanced for High Milk Production. the Number of Groups Used on a Particular Farm Will Depend on Factors Such as, the Size, Number of Cows on Farm, Milking Parlour and Holding area Constraints, Milk Production Level of Herd, and Labour Constraints.

Factors Effecting Tmr Feeding System

- Particle Size: Check Particle Size of the Tmr. Every Two to Four Weeks, the Particle Size of the Tmr Should Be 2 to 3 Cm (Fibre Length).
- Proper order of ingredients in the Tmr: It Is Important to Maintain Length of forage Fibre in Tmr.
- There are Two Type of Mixer Is Used for Mixing the ingredient for Tmr Preparation.
 - Auger/ Reel Mixer Grains/Cakes → Mineral Mixture/ Vitamin/Feed additives → Chaffed Hay → Silage
 - Vertical/ Screw Mixer Long Hay → Grains/Cakes → Mineral Mixture/Vitamin/Feed additives → Silage

Timing of Feeding

a Tmr Can Be Fed once Per Day, But Twice Per Day Is Preferable Especially During Hot, Humid Summer Months. Feeding Twice Per Day, once in the Early Morning and once in the Evening Keeps the Feed Fresher and Encourages Feed intake.

Watch Out for Sorting

Cows Will Take their Noses and Wiggle Down Through a Tmr to Sort Out the Grain from the forage. This Process Provides the Rumen Microbes with a Few Mainly Grain Meals and a Few Mainly forage Meals Per Day, Just Like Component Feeding without a Tmr. the Result Is acidosis. Ration Dry Matter Can Dramatically affect the incidence of Sorting. in the Drier Ration More Sorting Happen Will Be in Case of More Drier Ration. Sorting Has Been Reduced When Water Was added to Rations Containing More Than 50% Dry Matter to Bring Ration Dry Matter Down to 43%. also, If the Ration Is too Coarse (Especially with Coarse-Cut Dry Corn Silage) Cows Will Sort More. Feeding Cows More Frequently Will also Help Reduce Problems with Sorting. Observe Feed Refusals in General, Feed Refusal Should Not Exceed 3 to 4%. Feed Refusals Can Be Fed to Older Heifers, Steers, or Other Beef Cattle. Refusals Should Never Be Fed to Pre-Fresh or Early Lactating Cows. First-Calf Heifers Should Be Placed into a Higher Group Than their Production Level to Compensate for Growth That they Will Have in the First Lactation. If there are Long forage Particles, Corn Cobs or Other Noticeable Large amounts of any Single Feed ingredient, This indicates Cows are Sorting and Not Consuming a Balanced Ration. Either Chop the Long forages or Particle Feeds Finer or Replace them in the Tmr with Feeds That are More Difficult to Sort.

4.5 Hay Making

The Objective in Haymaking Is to Reduce Moisture in Green Fodders to a Sufficient Degree So That they Can Be Stored without Fear of Fermentation Losses or Spoilage Due to Mould Growth. in That Process the Endeavour Should Be to Preserve the Maximum amount of Nutrients Possible. the Stage of Maturity of the Crop at the Time of Cutting Is Very Important as Far as Nutritive Value of the Hay Is Concerned. an Early Cut Means More Nutritive Value But Less Yield. Late Cuttings on the Other Hand Will Result in Less Nutritive Value But More Bulk.

Properties of Good Hay

- The Fodder Cut at the Proper Stage Will Have the Maximum Nutrients and, therefore, Will Make Better Hay. Delay in Harvesting Fodder for Haymaking Will Make the Stems Woody and Lignified with the Resultant Deterioration in the Nutritive Value. Besides, a Part of the Nutrients Would Have Been Used Up in Seed formation. Thus, Crops Cut at the Proper Stage Can Make Good Quality Hay.
- Good Hay Will Be Having a Major Proportion of the Leaves intact. the Leaves are Richer in Nutrients Compared to Other Parts. Shattering of Leaves During the Process of Haymaking Will, therefore, Reduce the Quality of Hay.
- Green Colour of Hay Is an indication of Its Quality. It Means That a Greater Proportion of the Leaves Have Been Preserved and Losses Due to Bleaching, Leaching, Fermentation, Etc Have Been Minimized.
- It Will Be Made Out of Thin-Stemmed Crops So That It Is Soft and Palatable.
- The Crop Used for Haymaking Should Be Free from Weeds and Poisonous Plants to Get Good Hay.

- Hay Should Not Have More Than 20-23 Per Cent Moisture When Stored. If there Is More Moisture, Fermentation Will Take Place, Generating a Great Deal of Heat. Ultimately It May Lead to Spontaneous Combustion. Even If It Does Not Catch Fire, the Nutritive Value Would Have Seriously affected.
- Good Hay Will Be Free from Dust and Mould.
- It Will Have a Pleasant aroma, Which adds to Its Palatability

How to Make Hay

- **Selection of Suitable Plant Varieties** and Its Cultivation on Good Soil with Proper Care in the form of Watering, Fertilization, Etc. the Seed Rate Should Be High Ensure Dense Stand of the Crop, Which Will Result in Finer Stems, Heavier Yield and Less Weeds.
- **Cutting the Fodder at the Proper Stage of Maturity.** for Lucerne, in the First Cut, It Is the Early Bloom Stage and in the Second and Subsequent Stages, It Is When one-Tenth to one-Fourth of the Crops are in the Bloom. for Grasses, It Is When they Begin to Head Out, for Grain Crops When Grain Is in the Milk Stage and for Cowpea When Pods are Half to Fully Matured.
- **Curing of the Hay:** in Curing Hay, the Objectives are to
 - (I) Preserve Maximum Nutrients, and
 - (ii) to Remove Moisture Sufficiently to avoid Mouldiness and Spoilage.

During Curing, Shattering Losses Should Be Minimized. in Leguminous Plants, Shattering Is More and Special Care May Be Taken to avoid It. Leaves Constitute Roughly 50 Percent by Weight But Contain More Than 70 Per Cent of the Protein and 90 Percent of Carotene.
- **Bleaching and Fermentation Losses:** Even Under Ideal Conditions there Is Loss of Nutrients During Curing. But, When the Temperature Is too High or When Moisture Content Has Not Been Kept Low Enough, Severe Losses Due to Bleaching and Fermentation Take Place. the Green Colour of the Hay Is More or Less Proportional to the Carotene Content. Losses in Nutrients Due to Leaching from Rain Is the Major Loss When one Tries to Make Hay During Monsoon Season. the Leaching Losses are Negligible If the Rain Falls Just after Cutting of the Crop. Losses increase with the advancement of Curing, If Leaching Takes Place.
- **Moisture Content of Hay:** from Freshly Cut Crop with Moisture Content of 70 to 80 Percent. Hay of Different Types Has to Be Prepared with the Following Moisture Content – for Loose Hay-- 25–28 %, for Baled Hay--22-25%, for Chopped Hay –19-22%.

in order to Judge Whether Hay Is Properly Cured, Two Thumb Rule Methods are available:

- **The Scrape Method.** with the Nail Try to Scrape the Epidermis from the Stem of the Plant. If the Epidermis Can Be Peeled from the Stem, It Is Not Sufficiently Cured.
- **The Twist Method.** a Small amount of the Hay Is Twisted in the Hands. If the Stem Breaks a Little and No ‘Plant Juice’ Comes Out from the Twisted Stems, assume That the Hay Has Been Cured Well.

Storage of Hay: Enough Care May Be Taken While Storing Hay to Protect It from Rain and Sunlight. there are Four Popular Methods of Haymaking. they are Field Curing, Mow Curing, artificial Drying and Pelleting.

Factors affecting Nutritive Value of Hay

- **Shattering of Leaves:** Common in Legumes. Leaves are Richer in Protein, Minerals, Vitamins Etc, If Over Dried Loss Will Be More
- **Fermentation:** Occurs in the Soluble Carbohydrates as a Result of Respiration. Sugars are Oxidized to CO₂ and H₂O. This Loss Results in the Concentration of Cell Wall Constituents Especially Cellulose and Lignin. This Is the Reason Why Hay Has More Crude Fibre Than That of original Herbage. Proteins are also Likely to Be altered by the action of Plant Enzymes.
- **Oxidation:** Loss of Carotene Occurs Due to Oxidation from 150-200 Mg to as Little as 2-20 Mg/Kg of Hay.
- **Leaching:** in Prolonged Heavy Rain there Will Be Loss of Soluble Minerals, Sugars and Nitrogen Constituents Resulting in High Concentration of Cell all Constituents Which Is Reflected in High Fibre Content. Rain also Prolongs the Enzyme action Causing Greater Loss of Soluble Carbohydrates.
- **Action of Microorganisms:** If Drying Is Prolonged Because of Bad Weather, Changes Will Be Brought about by Bacteria and Fungi Results in Mouldy Hay. these Fungi (Actinomyces) infected Hay Is Responsible for allergic Disease Condition “Farmer’s Lung” in Farmers Who Handle Such Damaged Hay.
- **Stage of Growth:** If Grass Is Cut at a Later Stage, It Will Result in Poor Nutritive Value.

4.6 Silage Making

Silage Making Is one of Several Methods Used for Conserving animal Feed for Those Times When there Is Less animal Feed available. the Process of Silage Making includes Cutting Fresh (Green) Fodder, Compacting It, and Storing and Fermenting It Under Controlled Conditions in a Silo, Where air Cannot Come in Contact with the Silage. any Green forage Crop Can Be Made into Silage. for Example: Fresh Grass; Legumes, including alfalfa (Lucerne), Clovers, Vetches, Cowpeas, or a Mixture of these; Fodder Crops Like Maize, Millet, Oats, Rye, Wheat, and Varieties of Sorghum; Crop Residues, including Fruit Residues and Other Waste Products; Other Locally available Crops.

Advantages of Silage

- Will Keep forage in Good Condition for a Very Long Time without an Excessive Loss of Feed Nutrients (E.G. Compared to Hay).
- Provides High-Quality Ruminant Feed During the Dry or Cold Periods.
- Allows for Other Products to Be added (E.G. Molasses) to Prepare a More Complete Feed Ration.
- Can Be Made When It Is Not Possible to Make Hay Due to Weather Conditions Such as Rain.
- Increases Palatability and Digestibility of Most Fodder Crops.
- Requires Less Storage Space Compared to Hay.
- Can Enable Fields to Be Cleared Early for Other Crops to Be Planted.
- It Is a Better Source of Protein and Carotene Than Hay.
- The Ensiling Process Is the only Means by Which the Entire forage Plant Can Be Preserved in a Succulent form. the Crops Can Be Harvested and Stored at the Time of Its Development When It Has the Maximum Nutritive Value.
- Retains High Proportions of Nutrients Than Hay Because Losses Due to Shattering and Bleaching are Minimized. Silage Preserves 85 Per Cent of Its Energy. Hay Under Best Conditions Preserves only 80 Per Cent and Under Poor Conditions 50-60 Per Cent.

- Silage Crops Have More Yield Than Other Hay-Crops. Earlier Cuttings at Higher Levels of Digestibility are Possible. Thus, More Feed Nutrients Can Be Grown on an acre of Crops Used for Silage Than an acre Used for Most Other Purposes.
- Mechanization from Field Cutting to Feeding Is Easier with Silage.
- Practically any forage Crop Is Fit for Ensiling. Weedy Crops and Crops with Thick Stalks Can Be Ensiled Equally Well.
- Many by-Products Can Be Economically Used.
- There Is a Wider Choice of Feeding Methods for Silage.
- Ensiling Ensures Better Storage for a Long Time

Disadvantages

- Requires Silo and Special Equipment.
- Less amount of Vitamin D in Silage Than Hay.
- Additional Expenses are involved for Preservatives.
- Due to Moisture Content, tonnage and Transporting Charges are increased.
- Wet Silage Can Present Difficult Problems of Disposal of Effluent.
- Smell from Poorly Fermented Silage Can Create Problems.
- Wastage May Be High When Minimal amounts are Made at one Time.

Preparation of Good Silage

Good Silage Should Have a Mild, Pleasant aroma, an acid Taste and a Slightly Greenish Colour. It Should Be Free from Sliminess and Mould Growth and Should Have Sufficient acid to Prevent Further Degradation. Successful Ensilage Can Be achieved by Following the Steps Listed Below.

- The Crop Should Contain adequate Level of Sugars for acid Fermentation.
- Ensile forage Species Having Naturally High Sugar Content Like Maize, Sorghum and Meadow Fescue.
- Avoid Heavy Content of Legumes in the Crop as they Have Low Sugar and High Protein Contents, Which Favour the Growth of the Clostridia.
- Do Not Cut Immature Crops for Silage Making as they Have High Protein and Low Sugar Contents. Crops for Silage May Be Cut once they are Mature and May Be Cut Late in the Day as Sugar Content increases During the Hours of Sunlight.
- When a Crop Is Known to Be Deficient in Sugar, add Molasses as Uniformly as Possible Before Ensiling.
- The Crop Should Not Have High Moisture Content: avoid Cutting Immature Crops with High Moisture Content, although Delaying too Much Will Reduce the Digestibility of the Crop.
- Avoid Cutting Crops When Soaked in Rain or Dew. If Necessary, Wilt the Crop in the Field Before Transporting to the Silo.
- Consolidate and Rapidly Seal the Silo as the Oxidation of Sugars Can Produce Water.
- Also, Seepage of Rainwater inside the Silos Should Be Prevented.
- Exclude air from Silage: When the Crop Is Filled inside the Silo, air Is Trapped in the Meshes of the forage. Oxidation of Sugars Takes Place with Generation of Heat. This Causes the Trapped air to Rise and Set Up Currents, Which Draw in Fresh air. Rapid Filling, Consolidation with a Tractor, Chopping or Lacerating, Evacuation Pump for Further Compression of the Fodder, Etc. are Helpful. by Combining Consolidation with Quick and Perfect Sealing, the air-Free Condition Needed by Lactobacilli Is Quickly

Established While at the Same Time the Maximum amount of Sugar Remains to Be Fermented.

- Seal the Silo as Soon as Filling Is Finished. This Seal Will Have Several Functions. While the Silage Is Warm It Prevents the Warm air from Escaping and Setting in Currents Bringing Fresh air. It also Prevents Entry of Fresh air When the Fermentation Has Been Finished and thereby Keeps the Silage Stable. in Un-Roofed Silos, This Prevents the Entry of Rain Water and Diluting the acid Which Will Cause Rotting of Silage.
- Wilting Is Perhaps the Most Controversial aspect of Silage Making. Excellent Silage Can Be Made from Crops with High Moisture Percent Provided Enough Sugars are available for Producing Enough acidity. But Immature Crops with High Moisture Content are always Low in Sugar Content also. therefore, Wilting Is Necessary in their Case to a Level of 25-30 Per Cent Dry Matter. If an additive Is added, Less Wilting Will Suffice. an advantage Claimed for Wilting Is That It Will increase the Dry Matter Consumption of animals Especially When animals are Fed Mostly Silage.
- **Additives:** Silage Making Is a Chemical Process and, therefore, Many Ways of Chemically Preserving Silage by adding Certain Substances Have Been Successful. Several Broad Classes of additives Have Been Tried:
 - 1.Those Which Supply additional, Readily Fermentable Carbohydrates to Produce Preserving acids, E.G., Molasses, Sugar. Usually Molasses Is added at the Rage of 2% of the total Fodder.
 - 2.Mineral acids (Mixed Hydrochloric and Sulphuric acids) Which Give a Stable, Very Low Ph Silage, and
 - 3.Organic acids Especially Lactic and formic acid – Which Help in achieving a Stable Ph More Rapidly. alternatively, a Culture of Lactobacilli Can Be Used.

Additives are Not Needed in Making Silage from Crops Wilted above 30 Per Cent Dry Matter or with High Sugar-Crops Wilted above 25 Per Cent Dry Matter. they are Necessary for Crops with High Moisture, High Nitrogen, and/Or Low Sugar Such as Legumes. Not only an additive Reduces Silage Losses, It also Gives an acceptable Feed.

Opening and Closing the Silo: Try to Open only the Part of the Silo That You Will Use in Three or Four Days and Cover as Best as Possible Between Feedings. During the Feeding of the Silage, the area Exposed to air Should Be as Small as Possible and the Time Between Opening and Closing the Silo as Short as Possible. Uncover and Remove Just the Silage That You Need and Not More to avoid any Exposure to air and Heating. Unnecessary Exposure to the air and Heat Will Spoil the Silage with Mould. after Feeding, Keep the Leading Edge of the Plastic Sufficiently Weighted Down to Prevent air from Entering.

Types of Silos

A Very Large Number of Different Types of Silos are in Existence. these Vary from Massive Concrete Structures with Complete Equipment to Simple Plastic Bags. Other Types include Conventional tower Silos, Trench Silos, Pit Silos, Tube Silos, Clamp Silos, Wire and Plastic Silos and Bunker Silos.

- Tower Silos are Cylindrical Concrete Structures about 8-10 Metres in Diameter and 15 Metres in Height. Fresh forage Is Blown in at the top and When Ready for Use the Silage Is Removed Through a Serious of Openings at one Side.
- Trench Silos, as the Name Implies, Is a Shallow Horizontal Pit. Its advantage Is That It Is Readily accessible, thereby Reducing Labour Costs. a Low Matter Table and Clay Soil

are Desirable in the Location of Trench Silos. often the Trench Can Be Dug into the Side of a Hill to increase accessibility.

- Pit Silos, as the Name Implies, are Pits for Silage Making. in Large Operations It involves More Labour.
- Tub Silos are Upright of a Very Wide Diameter. these Tub Silos are Fairly Easy to Unload by Hand.
- Bunker Silos are Suitably Made in areas Where Soil Is Loose and When Water Table Is High. they are above Ground Structures Composed of Walls Between Which Ensilage Is Compressed. the Walls May Be of Wood, or Concrete. forage Is Put in and Taken Out of Bunker and Trench Silos in Much the Same Way. Trucks or Tractor Trolleys Loaded with Chaffed Fodder Can Be Driven in, Unloaded and Driven Through. forage Is then Packed with Tractors Equipped with Blades.
- Clamp Silos Can Be Made Where Soil Is Suitable and the Water Table Is High. a Shallow Trench Is Dug and the Soil Is Piled on Either Side to increase the Height of the Walls. Pack Ensilage as High as Possible and as Compactly as Possible. a Good Plastic Sheet Is installed on top.
- Plastic Sheets are Used in Different Ways to Produce Silage. Silos of Various Sizes Can Be Prepared with Plastic Film and Welded Wire Fencing.
- Silage Bags are Made of Smaller Tubes of Plastic. they are Small Silos of 50 Kg or Even Less. Thus, for Small Livestock Operation inexpensive Silage Structures are available. the End of Each Tube Is Double Tied Making a Bag with a Handle at Each End.



Kaccha Trench silo pit



Kaccha Bunker Silo



Pakka Trench Silo Pit



Pakka Bunker Silo



Filling of silo pit





Pressing of chaffed fodder



Fodder pressed in silo pit



Fodder stored in silo pit

Different Grade / Kinds of Silage

- Very Good Silage Will Have Good Smell, Ph Will Be 3.7 – 4.2, Less Than 10% ammonia of total Nitrogen. No Butyric acid or Moulds are Present in This Class.
- Good Silage Will Have Satisfactorily Smell, Ph 4.2 -4.5, ammonia N Will Be Between 10-15% of total N and Will Contain Least amount of Butyric acid.
- Fair Silage Will Contain Little amount of Butyric acid Hence It Will Have Slightly Bad Odour, Ph 4.5-4.8 and ammonia N Rages Between 15-20% of total N.
- Bad Silage Will Contain More of Butyric acid Hence It Will Have Bad Smell and Ph Will Be Higher Than 4.8. This May Contain More Than 20% ammonia N of total N. Break Down of amino acid to amine Like Histamine, Tryptamine and Phenyl Ethylamine.

Table: Sensory Evaluation of Silage and Its interpretation

Parameter	Interpretation
A. Colour of silage	
Very dark olive to dark olive	Wilted legumes, silage with limited fermentation
Light green to green	Colour of good quality silage for maize, cereals and other grass silages
Light amber brown	Typical colour for more mature grasses and cereals or low DM silages
Brown to dark brown	Overheating, inadequate compaction or aerobic spoilage
B. Aroma of silage	
Mild, pleasantly acidic, sour milk or natural yogurt smell	Normal lactic acid fermentation Desirable
Sweet, fruity alcoholic aroma	Yeasts played role in the fermentation, Ethanol levels high. Silages are often unstable during feedout.
Sour vinegar smell	Poor fermentation dominated by bacteria producing acetic acid. Common with low DM, low-sugar forages. Intake likely to be depressed.
Rancid butter, putrid aroma	Poor fermentation dominated by clostridia bacteria that produce high levels of butyric acid. Intake likely to be depressed
Strong tobacco or caramel smell with flavour of burnt sugar	Heat-damaged silage, dark brown in colour. Often palatable to stock but have low in nutritive value

Mixing of Concentrates and Roughages

- Traditionally, Concentrates are Fed at the Time of Milking. Roughages are offered Either Before or after Milking.
- In High Producers, When Concentrates are Fed in Heavy Doses at Milking Time, the appetite of the Cows Will Be Reduced Temporarily and they May Not Eat Roughages for Some Time.
- Consequent, there Will Be 4 Different Fermentation, Two Primarily Due to Concentrate and Two Primarily of Roughages.
- The Feeding of Concentrates Separately from Roughages During a Four-Time Feeding Schedule Reduces acidic acid Production and increases Propionic acid.
- It Has Been Observed That Feeding Grain on top of Silage increased the Fat Percentage of Milk Production.
- Feeding Concentrates Either on top of forages or Mixed with forages Has Been Found to Favour Optimum Rumen Fermentation.
- This Has Led to the Concept of Complete Feeds Which incorporates Both Roughages and Concentrates.

Complete Feeding

- In order to Simplify Feeding of Dairy Cows, Complete Diet System Have Been introduced.

- Complete Diet Is an intimate Mixture of Concentrate and Roughages in a Desired Proportion Processed in Such a Way as to Preclude Selective Eating. It forms the Sole Source of Food for the Cow.
- It Reduces Labour Requirement and Keeps a Tighter Control on the Cow's Nutrition.
- It also Facilitates the application of Least Cost Method of Ration formulation.
- Feeding of Complete Diet ad Llibitum to Dairy Cow Has Been Found to Be advantageous in That It increases Feed intake, Preserve Milk Quality as Result in Better Utilization of Nitrogen.
- These are in addition to the Most Obvious advantage of Prevention acidosis from Over-Eating of Concentrate by High Producer.
- The Complete Diet Feeding System Is Radically Different from Conventional Feeding Method in That there Is No individual approach in Feeding Cows.
- Group Feeding Is Practiced in Complete Feeding System. there are also Fewer Changes in Diet formulation according to the Milk Yield.
- This Has Come as a Result of the Experimental and Practical Feeding Observation That Yield and Efficiency are Not Improved by individual Rationing Compared to Flat Rate Feeding of Cows Grouped according to Milk Yield or Stage of Lactation.

4.7 Transition Management (Dry Cow to Milking)

The top Five Factors for Transition Cow Success are:

- Sufficient Feed Space
- Cow Comfort with appropriately Sized Cubicles
- Soft Bedded Lying Surfaces
- Minimal Social Stress
- Effective Post-Calving Screening Programmes.

Feed and Water Space: Being Herd animals, Cows Like to Eat together, and So Sufficient Feed Space Is Recommended So That all animals Can access Feed at the Same Time. the Target Should Be to Provide a Minimum of 75cm Feed Space Per animal But 85cm Is Preferable to aid Good Dry Matter intakes and Reduce Competition at the Feed Fence. the aim with Dry Cow Feeding Is to Maximise Dry Matter intake to Maintain Good Rumen Fill and Management of Body Condition to achieve the Target 3-3.25 for Calving. the Target Rumen Fill Scores for Dry Cows are Either 4 or 5.

Heifer Management: If Heifers Have to Be Mixed with Cows Pre-Calving, they Should Be introduced around Six Weeks Prior to Calving. However, If It Is Possible to Manage Heifers as a Separate Group Up to and Even Ideally Beyond Calving, This Will Minimise the Risk of Social and infectious Stressors. the Closer to Calving That Heifers are Moved into the Dry Cow Group, the Greater the Impact Stress Can Have on them at Calving Time. as Heifers Tend to Be Lower in the Pecking order, It Will Be the Heifers That Tend to Struggle the Most in Facilities with insufficient Lying and Feed Space.

Other Considerations for Transitioning Heifers into the Milking Cow Herd include:

- Ensuring Heifers are Cubicle Training During the Rearing Period If they are to Be Housed in Cubicle accommodation During the Dry Period and/Or When introduced to the Milking Herd. If Heifers are to Be Housed after Calving, Feet Problems in Early Lactation Can Be Reduced with Exposure to Concrete Floors Prior to Calving.

- Before Calving Make Sure Heifers Have Experience of Equipment or Procedures they Will Encounter after Calving, Such as the Milking Parlour or Robot, Shedding Gates and Footbaths, and Have Had Sufficient Contact with People to aid Ease of Handling.

- Vaccinations Must Be Up to Date So That Heifers are Protected from any Diseases Present in the adult Herd. Post-Calving Protocols Early Detection of Health Issues Post-Calving Is Critical for Treatment to aid Quick Recovery and Minimise the Impact It Could Have on Milk Production and Fertility. Freshly Calved Cows Should Be Monitored to assess their Demeanour, Willingness to Get Up and Feed and Milk Yield for the First Five Days. If there Is any Cause for Concern, Carry Out a Vaginal Examination and Check Rectal Temperature.

The Following Checks and Procedures after Calving are Recommended:

- Rectal Temperature - Target 38.5°C. a Temperature >39.5°C Is a Cause for Concern and Could indicate an infection or inflammation Problem.
- Rehydration - after Calving Provide Warm Water (15-20 Litres at 18-25°C) and offer Milking Cow Ration as Soon as Possible to aid Calcium intake.
- Check the Placenta Is Expelled within 24 Hours, Otherwise It Is Classed as a Retained Placenta and If Not Treated Promptly Could Develop into Metritis.
- Check Quarters for Mastitis.
- Check for Uterine Discharge.
- Record Body Condition Score.
- Check/Observe for Ketosis - First Lactation Heifers, Cows with a Bad Calving or Gave Birth to Twins May Be More Prone to Ketosis. Cow-Side Milk and Urine Dipstick Tests are available, as Well as Blood Ketone Meters. Cows Should Be Tested for Ketones within the First Two Weeks of Calving.
- Vet Checks at Routine Fertility Visits Will also Help Detect any Problems for Getting Cows Back in Calf. all Cows Should Be Checked at one-Month Post-Calving for Metritis and to See Whether they Have Ovulated.

Benchmarking Transition Performance: the Success of Dry Cow Management Can Be assessed by Recording the incidence of Transition Diseases. the Following Table Gives Suggested Targets to aim for, and Changes to Nutrition and/Or Management Should Be Implemented When incidence Is above Target Levels. It Is Best to Set Realistic and achievable Goals in Conjunction with Your Vet Based on Current Herd Performance and Review Performance against the Targets on a Regular Basis.

Table: Targets for Transition Disease incidence

Transition disease	Target level
Milk fever	< 5%
Retained foetal membranes (beyond 24 hours)	< 5%
Metritis	< 10%
Endometritis	< 10% in cows over 3 weeks calved
Mastitis (of dry period origin)	< 1 in 12 cases in first 30 days of calving
Ketosis in first 3 weeks (clinical)	< 5%
Ketosis in first 3 weeks (sub-clinical)	< 15%
Displaced abomasum	< 3%

A Successful Calving and introduction to the Milking Herd Is Down to a Combination of Factors, of Which Nutrition Is only Part of the Jigsaw. Space, in Terms of Feed and Lying Space are Crucial and the Effect of Stress from Pen Moves and Unfamiliar animals Should Not Be Underestimated. Maintaining Stable Social Groups and Minimising Pen Moves Will Help Keep Stress to a Minimum. once the Cow Has Calved, there are Several Checks That Should Be adhered to for Early Detection and Correction of any Health or Nutritional Issues.

Challenge Feeding after Calving

Transition Phase (Three Weeks Before and after Parturition) Is Viewed as the Most Stressful Time in the Production Cycle of a Dairy Cow. the Primary Challenge Faced by the Cow at This Time Is a Sudden and Marked increase of Nutrient Requirements for Milk Production with Concomitant Decrease in Dry Matter intake. to Make Up This Deficit, Energy Dense Rations are Generally Provided in Early Lactation Which Pre-Disposes the animal to Sub-Acute Ruminal acidosis and Lactic acidosis. Prior adaptation of the Rumen to these Energy Dense Rations Can Mitigate the above Risks. Hence Priming the Rumen of the animal by Feeding Energy Dense Rations at a Higher Level Starting from the Pre-Partum Transition Period Itself Will Help in increasing the absorptive Capacity of Rumen by Elongation of Rumen Papillae and Will also Help the Rumen Microflora to adapt to Diets Rich in Fermentable Carbohydrates. increasing Energy Density of the Pre-Calving Rations by increasing the Concentration of Non-Fibre Carbohydrates Has Been associated with increased Milk Production. the Pre-Partum Dry Matter intake (Dmi) Was Positively Correlated with Post-Partum Dmi and That Pre-Partum Dmi Should Be Maximized to Improve Postpartum Performance and Health.

Post-Calving Challenge Feeding Is Practised with a Motive to Elicit the Maximum Production Potential of the animal, by Gradual increments in the Concentrates Fed, Over and above the Requirement of the animal. animals Maintained on a Higher Plane of Nutrition (20% above Nrc) from 60 Days Pre-Partum to 120 Days Postpartum Have Been Reported to Produce 17.75 % More Milk When Compared to animals Fed as Per Nrc Feeding Standards.

Challenge Feeding Means the Cow with Potential of High Milk Production are to Be Fed increase amount of Concentrate to Challenge them to Produce to the Maximum. Challenge Feeding Starts Two Weeks Before the Expected Date of Calving. This Challenge Feeding Will Condition Her Digestive System for the increased Quantity of Feed to Provide Sufficient Nutrient to initiate Lactation on the Higher Plane. Generally, the animals are Started with 1.5 to 2.0 Kg Concentrate Mixture (@0.3 to 0.5% of Body Weight) on the Date 2 Weeks Before Calving Followed by an increment of 0.3 to 0.5 Kg Daily, So That they Will Be Receiving about 1 Kg Concentrate Mixture Per 100 Kg Body Weight at Calving. This Is Practice to Challenge the Cow to Reach Her Maximum Milk Production Potential.

- Challenge Feeding Starts Two Weeks Before the Expected Date of Calving (Steaming Up). Feeding Concentrate Mixture Should Be Started initially at 500 G Per Day and increase It Gradually to a Level of 500 -1000g Per 100 Kg Body Weight.
- High Milk Producing animals are Fed increasing Quantity of Feed Challenging them to Produce at their Maximum Potential. This Challenge Feeding Will Condition Her Digestive System for the increased Quantity of Feed to Provide Sufficient Nutrients to initiate Lactation on a Higher Plane. This Effect Has Been Found to Have Higher total Milk Yield in the Lactation.
- In the Light of advances Made in the Field of Protein Metabolism, the Protein Requirements in Ruminants are Calculated Based on Rumen Protein Degradability.

- Mobilization of Body Reserves During Early Lactation Can Be Prevented by Feeding High Fat, High Protein Oilseeds Such as Cottonseed Which Supply Both Protein and Long Chain Fatty acids (Lcas) for Post Ruminal Digestion (By-Pass Protein and by- Pass Fat).
- After Calving, the Concentrate allowance Should Be increased by 500 G Per Day in the First 2 Weeks of Lactation Until the Cow achieves Peak Yield Somewhere in the Second Month of Lactation on Free Choice Basis.
- After This the Milk Yield Is Tested and the Concentrate allowance Is Fixed accordingly.

Challenge Feeding Schedule:

Period	Concentrate allowance
Last 2 Weeks Before Calving	Starting from 500g, increase 300 - 400g Daily Until the Cow Is Eating 500 – 1000g Per 100kg Body Weight.
First 2 Weeks of Lactation	Increase 500g Per Day to Free Choice Level.
Second Week to Peak Yield (Test Day)	Free Choice
From Test Day onwards	According to Production as Per Thumb Rules. E.G. 1kg for Every 21/2 Kg Milk Produced
Remaining Lactation	Concentrate adjusted to Monthly Test of Milk Production
All Periods	Green Fodder and Dry Fodder Given adequately

5. ANIMAL HEALTH MANAGEMENT

5.1 Preventive Health Management for Nutritional Related Issues

Acidosis

Rumen acidosis is a metabolic disease of cattle. Like most metabolic diseases it is important to remember that for every cow that shows clinical signs, there will be several more which are affected sub-clinically.

Acidosis is said to occur when the pH of the rumen falls to less than 5.5 (normal is 6.5 to 7.0). In many cases the pH can fall even lower. The fall in pH has two effects. Firstly, the rumen stops moving, becoming atonic. This depresses appetite and production.

Secondly, the change in acidity changes the rumen flora, with acid-producing bacteria taking over. They produce more acid, making the acidosis worse. The increased acid is then absorbed through the rumen wall, causing metabolic acidosis, which in severe cases can lead to shock and death.

Cause

The primary cause of acidosis is feeding a high level of rapidly digestible carbohydrate, such as barley and other cereals. Acute acidosis, often resulting in death, is most commonly seen in 'barley beef' animals where cattle have obtained access to excess feed. In dairy cattle, a milder form, sub-acute acidosis, is seen as a result of feeding increased concentrates compared to forage.

Symptoms

Acute acidosis often results in death, although illness and liver abscesses may be seen beforehand. Cattle may become depressed, go off feed, have an elevated heart rate or diarrhoea.

- Reduced feed intake
- Poor body condition and weight loss
- Unexplained diarrhoea
- Temperature
- Pulse rate and respiratory rate may rise
- Lethargy

Treatment

Because subacute ruminal acidosis is not detected at the time of depressed ruminal pH, there is no specific treatment for it. Secondary conditions may be treated as needed.

Prevention

- The key to prevention is reducing the amount of readily fermentable carbohydrate consumed at each meal. This requires both good diet formulation (proper balance of fibre and non-fibre carbohydrates) and excellent feed bunk management. Animals consuming well-formulated diets remain at high risk for this condition if they tend to eat large meals because of excessive competition for bunk space or following periods of feed deprivation.
- Feeding excessive quantities of concentrate and insufficient forage results in a fibre-deficient ration likely to cause subacute ruminal acidosis. The same situation may

Be Seen During the Last Few Days Before Parturition If the Ration Is Fed in Separate Components.

- Including Long-Fibre Particles in the Diet Reduces the Risk of Subacute Ruminal acidosis by Encouraging Saliva Production During Chewing and by increasing Rumination after Feeding. However, Long-Fibre Particles Should Not Be Easily Sorted away from the Rest of the Diet; This Could Delay their Consumption Until Later in the Day or Cause them to Be Refused Completely.
- Ruminant Diets Should also Be formulated to Provide adequate Buffering. This Can Be accomplished by Feedstuff Selection and/Or by the addition of Dietary Buffers Such as Sodium Bicarbonate or Potassium Carbonate. Dietary anion-Cation Difference Is Used to Quantify the Buffering Capacity of a Diet.
- Supplementing the Diet with Direct-Fed Microbials That Enhance Lactate Utilizers in the Rumen May Reduce the Risk of Subacute Ruminal acidosis. Yeasts, Propionibacterium, Lactobacilli, and Enterococci Have Been Used for This Purpose. Ionophore (E.G., Monensin Sodium) Supplementation May also Reduce the Risk by Selectively inhibiting Ruminal Lactate Producers.

5.2 Ketosis

Ketosis Is a Metabolic Disorder in High Yielding Cattle and Buffalo Which Occurs When Energy Requirement of the animal Exceeds the Energy intake Which Results in Negative Energy Balance. This Condition Occurs Due to Low Blood Glucose Levels. During Glucose Deficiency the Body Fat Is Mobilized and Processed in Liver to Meet the Energy Requirements. When Higher Quantity of Fat Gets Mobilized, these Fatty acids are Not Properly Metabolised in the Body Leading to increased Level of Ketone Bodies (Acetone, acetoacetic acid and Beta-Hydroxybutyric acid) in the Blood and accumulation of Fact in the Liver. Low Blood Sugar, High Level of Ketone Bodies in Blood and Presence of Ketone Bodies in Urine are the Characteristic Features of Ketosis. Reduced appetite in Later Stage of Gestation or after Calving or Due to Disease Conditions Is one of the Causes for Ketosis. the Condition Is Highly Economically Important as It Results in Reduced Milk Production During the Peak Lactation Period and Delayed Conception Leading to Longer inter Calving Period. If the Condition Is Untreated It Will Lead to Weight Loss and Emaciation.

Symptoms

- Drop in Milk Yield.
- Slight Reduction in Feed intake.
- Depression / Lethargy.
- Weight Loss.
- Particular acetone Smell (Fruity Odour) in Breath.
- Fever.
- Abnormal Gait, Humped Back Posture, Head/Muzzle Pressing.
- Pica, Biting of Coarse Surfaces.
- Nervous Signs, Circling, Staggering and Falling.
- There Can Be Silent forms of Ketosis in Which Symptoms Other Than Drop in Milk Yield are Not Shown.

Diagnosis

Display of Clinical Signs. Laboratory Detection of Ketone Bodies in Urine and Milk.

Treatment and Management

The affected animal Should Be Consulted to a Veterinarian. interventions Should Target Quick increase the Blood Glucose Level. oral administration of Jaggery Can Be Done. intravenous administration of 500ml of 50% Dextrose Solution Is the Common therapy. as This Solution Is Hyper Osmotic Care Must Be Taken. While injecting to avoid accidental Entry of This Liquid into the Surrounding Tissue. the Glucose administration alone Cannot Prevent Relapse of the Condition. administration of Glucocorticoids Like Dexamethasone along with Glucose Will Help in Maintaining Blood Glucose Level. Commercial Veterinary Preparations of Propylene Glycol Can Be Given orally at 250g/Day to Improve the Glucose Level. Vitamin and Mineral Supplements Should Be Given to Improve the Metabolism. animal Should Be Fed High Energy Rich Feed (Higher Concentration of Grains in the Feed).

Preventive Measures

During Later Part of Gestation

- Adequate Feeding.
- Excess Feeding of Energy Rich Concentrates Should Be avoided.
- The animal Should Be Given Proper Exercise During This Stage.

After Calving When the Milk Yield increases Suddenly

- The animal Must Be Provided with adequate amount of Energy Rich Concentrate Feed according to the Milk Yield.
- Sudden Change of Feed Should Be avoided.
- High Yielding animals Can Be Fed with by-Pass Fat to at a Rate of 15 - 20g/Kg Milk Yield to Prevent Negative Energy Balance.
- Sodium Bicarbonate May Be incorporated in Feed to Prevent Development of acidosis Due to Excess Concentrate Feeding.
- Probiotics, Vitamin and Mineral Supplements Should Be included in the Feed During the Entire Peak Lactation Period in order to Improve Feed Utilisation and Metabolism.
- The Feed Containing High Quantity of Urea and Silage Should Be avoided in Susceptible animals.
- Disease Conditions Like Retention of Placenta (Rop), Metritis, Mastitis and Environmental Stress Etc Should Be Treated Immediately.
- Regular Weekly Testing of Urine and Milk Samples Up to 2 Months after Calving Can Help in Early Detection of Ketosis and Immediate Treatment Should Be Given to Save the animal.

5.3 Milk Fever

Milk Fever Is a Disease of High Producing Dairy animals Occurring within one or Two Days after Calving. It Is Because of Low Calcium Supply Through Feeds and Hence the animal Is Unable to Meet the Demand of the Body's Requirement for Heavy Drainage of Calcium Through Milk.

Symptoms

- Depression and Unwillingness to Move and Eat.
- The Body Temperature Goes Below Normal and the Extremities Becomes Cold.
- The Muzzle and Nose Become Dry.

- The Eyes Become Dull and Expressionless and the Membranes Covering the Eye Turn Red.
- The animal Lies with Its Head Turned to one Side for Which the Neck assumes an S Shape.
- The Pulse and Breathing Become accelerated and Very often Breathing Becomes Laboured accompanied by Groaning.
- There May Be Bloating I.E. accumulation of Excessive Gases in the Rumen as the Gut Becomes Paralysed.
- The animal Goes to Coma and Death May Occur within a Few Hours.

Treatment

It Is always advisable to Call a Veterinarian When the animal Is Sick. Treatment by Farmers Based on the Observable Symptoms are Not at all advisable. Remarkable Success Can always Be Expected If Treatment Is Carried Out Properly. the Following Treatment Strategies Can Be Followed.

- Intravenous injection of Calcium Borogluconate (20% Solution) or Other Calcium Salts. Special Care Is Required While injecting Calcium Borogluconate So That It Is Not Made Under the Skin or the Solution Does Not Enter the Tissues Surrounding the Vein Since This Causes Irritation Which May Result Restraining of the animal Difficult.
- No Commercial oral Preparation Is available. But, for Suffering Cows Which are Still on their Feet or Have only Just Sat Down and Can Still Hold their Heads Up, an oral Preparation Can Be Suggested. the Recipes of That oral Preparation are as Follows:
- Dissolve Calcium Chloride (Around 150g, But Not More Than 200 G) in 200 MI of Warm Cider Vinegar.
- After Properly Dissolving the Calcium Chloride, add around 150 MI of Fish or Vegetable Oil.
- Then 50 G of Causmag or Dolomite Should Be added and the Volume of the Solution Should Be Made Up to 500-600 MI with Molasses.
- The Solution Should Be Shaken Thoroughly Before Feeding to the animal So That the Vegetable Oil Is Suspended Well. Vegetable Oil Helps to Protect intestinal Mucosa from Irritation Due to Calcium Chloride.
- It Is advisable Not to Give More Than Three Treatments with This Preparation as Calcium Chloride May Cause Stomach Ulcers. If at all Required Calcium Chloride Should Be Replaced with Lime Flour.

Indigestion/ Diarrhea/Enteritis

Inflammation of the intestinal Mucosa Resulting in Diarrhoea, Dysentery, abdominal Pain and Varying Degrees of Dehydration and acid- Base Imbalance.

Causes

The Enteropathogens Like Bacteria, Viruses, Fungi, Protozoa and Helminths, Chemical and toxins.

Clinical Symptoms

- Diarrhoea
- Dehydration, abdominal Pain, Septicaemia and toxæmia with Fever.
- Faeces are Soft or Fluid in Consistency and Unpleasant Odour.

- Contain Blood, Mucus/ foreign Materials Like Sand.
- Colour of Faeces Is Pale Yellow and Sometimes Frank Blood.
- Distribution of the Faeces on animal's Perineum.

Management Methods

- Preventive Measures
 - ❖ Ensure adequate Non-Specific Resistance by adequate Colostrum intake.
 - ❖ Vaccinate for Those Diseases for Which there Is an Effective Vaccine.
- Control Measures
 - ❖ Reduce infection Pressure.
 - ❖ Minimize Managemental and Environmental Stressors.

5.4 Bloat

Bloat Is Overdistension of the Rumen with Gases of Fermentation.

Causes

- Prevention of Coalescence of the Small Gas Bubbles and Entrapment of the Normal Gases of Fermentation.
- Production of Stable Foam.
- Frothiness of Ruminal Contents.
- Consumption of Lush, Young Pastures and Leaves Containing High Concentration of Soluble Protein of Leguminous Plants, Particularly alfalfa, Red and White Clovers and Grazing of Young Green Cereal Crops, Rape, Turnips and Legume Vegetable Crops.
- Feeding of High-Quality Hay.
- Feeding of High Grain Diet.
- Feeding of the Finely Ground Feed.
- Physical Obstruction to Eructation Occurs in Oesophageal Obstruction Caused by a foreign Body, Pressure Outside the Oesophagus and Obstruction of Cardia.

Symptoms

- Clinical Symptoms
- Obvious Distention of the Rumen and Entire abdomen.
- Discomfort with the animal May Stand and Lying Down Frequently, Kicking at Its abdomen and Rolling.
- Sudden Death with Distended abdomen.
- Dyspnoea and Grunting accompanied by Mouth Breathing.
- Protrusion of the tongue and Extension of the Head.

Management Methods

- Suggested First aid
- The Passage of a Stomach Tube or Trocarization to Release Large Quantities of Gas.

- An incision of about 10-20 Cm in Length Over the Left Paralumbar Fossa Through the Skin, abdominal Musculature and Directly into the Rumen.
- A Stick Is Tied in the Mouth Like a Bit to Promote the Production of Excessive Saliva.
- Administration of antifoaming agents Such as Vegetable Oils (Peanut, Corn, Soybean) and Mineral Oils (Paraffin) at Doses of 80-250 ML.

Prevention and Control Measures

- The Pasture Should Be Free from Leguminous Fodders and Bloat Producing Plants.
- Feeding Hay Before Turning Cattle on Pasture.
- Maintaining Grass Dominance in the Sward or Using Strip Grazing to Restrict intake.
- Allowing animals on Well Grown Mature Pastures Than Immature or Rapidly Growing Pastures.
- Grass- Legume Mixture with a Legume Content of 50% Is Suggested as the Maximum Bloat Safe Level.
- Prevention of High Energy and High Protein Supplement.
- Drenching of 60-120 ML of antifoaming agents Twice Daily (At Milking Times).
- Feedlot Rations Should Contain at Least 10-15% Cut or Chopped Roughage Mixed into the Complete Feed. Preferably the Roughage Should Be a Cereal, Grain Straw, Grass Hay.
- Grains Should Be Rolled or Cracked, Not Finely Ground.
- Pelleted Rations Made from Finely Ground Grain Should Be avoided.

5.5 thelitis

- This Condition Is inflammation of Teat Due to Entry of Pathogens into Teat.
- It Most Commonly Occurs in Milch animals.
- It Is Due to Unhygienic Measures and Environment.
- This Causes No Change in Colour and Consistency of Milk.
- Untreated Teat Results in Complete Destruction of Teat.

Clinical Symptoms

- Affected Teat initially Shows Reddening and Swelling of Teat.
- Infection Progress Leads to inflammation of Teat.
- Decreased Milk Production.
- Severe infection Leads to Destruction of affected Teat.

Prevention and Control Measures

- The animal's Environment Should Be Clean and Hygienic.
- The Floor of the Milch animal Should Be Periodically Cleaned with antiseptic Solution.
- The Milker Should Wash Hands Properly Before Each Milking.

- The Dipping of Teat after Each Milking May Be Effective in Preventing Entry of Pathogens into Teat.
- Affected animals Should Be Given Earlier Treatment to avoid Destruction of Teat.
- Affected animal's Teat Should Be Treated with Qualified Veterinary Doctor.

5.6 Preventive Health Management for Non-Nutritional Issues

Protection against Diseases

- Be on the alert for Signs of Illness Such as Reduced Feed intake, Fever, abnormal Discharge or Unusual Behaviour.
- Consult the Nearest Veterinary aid Centre for Help If Illness Is Suspected.
- Protect the animals against Common Diseases.
- In Case of Outbreak of Contagious Disease, Immediately Segregate the Sick, in-Contact and the Healthy animals and Take Necessary Disease Control Measures. (Vaccination Schedule Is Given in annexure IX).
- Conduct Periodic Tests for Brucellosis, Tuberculosis, Johne's Disease, Mastitis Etc.
- Deworm the animals Regularly.
- Examine the Faeces of adult animals to Detect Eggs of internal Parasites and Treat the animals with Suitable Drugs.
- Wash the animals from Time to Time to Promote Sanitation.

Vaccination

- Vaccination of Calves and adult animals Is an Essential Practice to Prevent the Disease Outbreak in Farm animals.
- It Should Be Started from the First Four Months of Calf Life.
- Anthrax, Brucellosis, Black Quarter, Haemorrhagic Septicaemia and Foot and Mouth Disease are the Major Diseases against Which Vaccination Should Be Done for Dairy animals.
- Vaccination Should Be Done by Qualified Veterinary Doctor and Should Be Done at Proper Season for a Particular Vaccine.
- While Purchasing Vaccine, Expiry Date Should Be Checked

Table: Vaccination Schedule for Calves

Vaccine	Age
Foot and Mouth	2 to 4 Months (First Vaccination), 2 to 4 Months after First Vaccination, Twice a Year thereafter.
Brucella	4 to 8 Months
Black Quarter (First Vaccine)	8 Weeks Before Weaning

Anthrax Black Quarter (2nd Vaccine) Haemorrhagic Septicaemia	6 Months
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Table: Vaccination Schedule for adult animals

Vaccine	Months
Foot and Mouth	January to February
Abortion Causing Brucellosis	March to April
Anthrax Disease	April to May
Foot and Mouth Disease (Twice a Year)	June to July
Black Quarter	August to September (Before Monsoon)
Haemorrhagic Septicaemia	September to October

Deworming

- Deworming Should Be Started from the age of First Week of Calf.
- A Single oral Dose of 10 G Piperazine adipate Is Recommended for the Calves Preferably in the First Week of Life to Control Neonatal ascariasis Especially in Buffalo Calves.
- Deworming Should Be Done Every Month for First 6 Months, thereafter once in Three Months.
- The Deworming Drugs and Dose Should Be Consulted with Qualified Veterinary Doctor.
- Overdose and Under Dose of Deworming Drugs Should Be Prevented to Check the Side Effects.

Tick Control

Ticks are Economically the Most Important Pests of Cattle and Other Domestic Species in Tropical and Subtropical Countries. they are the Vectors of a Number of Pathogenic Microorganisms including Protozoans (Babesiosis, theileriosis), Rickettsiae (Anaplasmosis, Ehrlichiosis, Typhus), Viruses (E.G., Kyasanur forest Disease Reported from Karnataka State of India; Crimean-Congo Haemorrhagic Fever Reported Time and again from Pakistan), Bacteria (E.G., Pasteurella, Brucella, Listeria, Staphylococcus) and Spirochaetes.

Ticks are Voracious Blood Suckers. Loss of Blood for their Rapid Development Impoverishes the Hosts. in Heavy infestation, Cattle Must Have More Feed Merely to Meet the Demands of the Parasites; the Growth of Young animals Is Retarded, and they May Remain Thin, Weak and Stunted. in Dairy Cows, Milk Production Is Greatly Reduced. Ticks Belonging to Genus Ixodes and ornithodoros Lahorensis are associated with Tick Paralysis Which Is a Specific Type of intoxication, Resulting from the injection of a toxin by Certain instars of Ticks Usually the

adult Females But Sometimes by Nymphs. although Economic Losses Due to Ticks are Mainly Due to the Diseases Which they Transmit, Financial Losses associated with Nagging Irritation and Depreciation of the Value of Skins and Hides (Upto 20-30%) are also Significant. in Severely Tick infested Young Cattle, Sometimes Ticks Have Been Found in the oral Cavity as Well as in the Stomach.

Control and Treatment

- Any Newly Purchased animal Should Be Completely De-Ticked Before allowing to Mix with Other animals.
- Carry Out Periodic application of acaricide on the animal.
- Each adult Tick Lays around 3000 Eggs and the Larvae Can Survive from 2-7 Months, Based on the Climate, without Feeding.
- All Cracks and Crevices in the Cattle Shed therefore Should Be Sprayed with a Higher Concentration of the acaricide along with application on the Body to avoid Re-Infestation. Flaming also Can Be Done Using a Flame Gun If available, with a Little Bit of Caution.
- The acaricide Group Should Be Changed often to avoid Resistance from Developing.
- The acaricide Should Be applied in Proper Concentration.

Foot and Leg Management (Disbudding)

Disbudding

- Disbudding Means arresting the Horn Growth at an Early age, When the Horn Root Is in the Bud Stage.
- Horn Serves No Useful Purpose.

Purpose

- Dehorned animals Need Less Space in the Sheds.
- Cattle with Horns inflict Bruises on Each Other That May Result in Heavy Economic Losses.
- Horned animals are a Danger to the Operator.
- Dehorned animals Can Be Handled More Easily.
- Prevents the Occurrence of Horn Cancer.
- Optimum age for Dehorning - 15 to 20 Days.

Methods

Hot Iron Method

- A Specially Designed Electric Dehorner Is Used for This Purpose. This Is Bloodless Method and It May Be Used at any Season.

- The Electric Rod with an automatic Control That Maintain the Temperature at about 10000^0 F, When applied to the Horn Bud for 10 Seconds Can Destroy the Horn Tissue.

Elastrator

- A Specially Made Thick Rubber Ring Is applied to the Base of the Horn.
- The Rubber Band Shuts off Circulation and the Horn Gradually Comes off. Small Buds Drop off in 3 to 6 Weeks and Large Horns May Take Even 2 Months.
- It Is a Painful Method and This Method Is Used on Cattle When the Horn Length Is about 5-10 Cm.

Chemical Method

- Caustic Potash or Caustic Soda Is the Common Chemical Used for Dehorning.
- These are available in the form of Paste or Solution.
- Clip the Hair around the Horn Buds and Surrounding area, apply a Ring of Vaseline to Protect the Eyes against Chemicals.
- Rub the Chemical Over the Buds Until Bleeding Occurs.
- Caustic Chemicals Will Prevent the Growth of Horns When Properly applied to the Horn Buds of New Born (Less Than 3 Weeks of age) Calves. the Chemical Destroys the Horn-Producing Cells around the Horn Bud.

Dehorning Saw or Clippers

- When Older Cattle are to Be Dehorned a Specially Designed Clippers or Saw are Used.
- A Considerable amount of Bleeding May Follow the Operations.
- To Prevent the Bleeding the Main Horn artery Should Be Tied off with a Cotton or Silk Thread.
- This May Be Done by Sliding a Sewing Needle Under the artery to Pull the Thread in Place Before Tying.
- It Is Necessary When Sawing or Clipping the Horns, to Take about Half an inch of Skin in order to Get at the Horn Roots.

Quarantine

- Quarantine Is the Process of Segregating apparently Healthy animals (Especially animal Being introduced into a Herd or into the Country for the First Time) Which Have Been Exposed to the Risk of infection.
- Quarantine Period Depends on the incubation Period of Diseases. in Practice, a Minimum Period of 30 to 40 Days Has Been Generally accepted as the Reasonable Period; But in Case of Diseases Like Rabies This Period Is Up to 6 Months.
- Normally Newly Purchased animals and animals Returned from Show Should Be Kept in the Quarantine Shed.
- The Shed Should Be Constructed at the Entrance of the Farm.

- They Should Be Dipped or Sprayed on the 25th / 26th Day to Remove the Ectoparasites.

Isolation

- Isolation Is the Process of Segregation of affected and in Contact animals from the apparently Healthy ones, in the Event of Outbreak of a Contagious Disease.
- Such Segregated animals Should Preferably Be Housed in a Separate Isolation Shed Situated Far away from the Normal animal House.
- If a Separate Shed Is Not available the animals for Isolation Should Be Tied at one End of the Shed as Far away from the apparently Healthy Stock as Possible.
- Attendants and Equipment for Sick animals Should Be Ideally Separate.
- If Due to Practical Reasons This Is Not Possible the Sick animals Should Be attended only after the Healthy Stock.
- The Equipment Should Be Thoroughly Disinfected after Use in the Isolation Group.
- The attendant Should Wash His Hands, Feet and Gumboots in antiseptic Lotions and Change His Cloths.
- The Isolated animals are Brought Back to the Healthy Herd only after they are Fully Recovered and the Chance of Passing on infection Is Removed.

Heat Stress Management

Amongst the Environmental Factors, Hot ambient Temperature Has Significant Impact on the Productive and Reproductive Performance of Livestock Species. Several Factors are Responsible for Causing Heat Stress and Major Factors are High ambient Temperature and High Humidity.

Signs of Heat Stress

- Animal Tries to Move towards Shade.
- Water intake Is Enhanced While Feed intake Is Reduced.
- Prefers Standing Than Lying Down.
- Increased Respiration Rate and Body Temperature.
- Increased Production of Saliva.
- Open-Mouth Panting.

Prevention

- Make Sure Cows Have Free access to Plenty of Fresh, Clean Drinking Water. Bear in Mind That Cows Can Drink More Water in a Shorter amount of Time When the Water Is 20°C Compared to Cold Water.
- Ensure Cattle Sheds are Well-Ventilated: Prevent Excessive Direct Sunlight and Use Fans to increase airflow.
- For Grazing Herds, Bring the Cows and Feed them inside During the Hottest Part of the Day, or Keep them inside During the Day and Let them Outside at Night.
- Keep the Cubicles Clean and Dry to Prevent Mastitis.

- Ensure Grazing Cows Have access to Shade.
- Lower the Temperature in Cattle Sheds by installing Fans and/Or Sprinklers.
- Modify Your Herd's Feeding Regime by Feeding Your Cows More often During Cooler Parts of the Day. adjust Your Herd's Diet in Consultation with Your Nutritionist.

5.7 Care of Calf and Cow at Birth

- A Few Days Before the Probable Date of Calving, Cow Should Be Transferred to individual Calving Pens.
- Preferably 1 to 2 Weeks Before the Expected Calving Date.
- The Number of Calving Pens Required on a Farm Depends on the Number of Breedable Cows and Heifer, Generally 5 Per Cent of This Number.
- Ample amount of Drinking Water, Laxative Feed and Generous Supply of Bedding May Be Provided.
- The Calving Pen Should Be Scrupulously Cleaned and Sterilized Before Bringing in the Cow.
- Antiseptic Solution Like Tincture Iodine or Povidone Iodine, Thread, Scissors, Lubricants Like Liquid Paraffin, Vegetable Oils, Obstetrical Equipments Like Hook, Snare, Calf Puller, Wire Saw; Emergency Drugs Like Local anaesthetics, antibiotics, analgesic, Calcium Borogluconate, Other Items Like Emergency Light, towel, Soap, Buckets, aprons Etc. Should Be Made available at all Time in the Calving Pen.
- In Villages or Farmers Those Who are Maintaining only one or Two animals Must Tie the animal in advanced Stage of Pregnancy Separately Under Visibility.
- It Must Be Protected from Predators. the Floor Should Be Dry and Clean and Having Clean Grass Cover Is Essential.
- The Cow Should Not Be Tethered too Close, It Must Be Tied with Sufficient Rope So That animal Can Move Freely and Care the New Born Easily During Night Time When Calving Is Unnoticed.
- If any abortion, Calves Should Be Examined Thoroughly to ascertain the Possible Cause for abortion (Age of the Foetus, Condition, Necrotic Foci If any Etc).
- In Such Cases the Calving Pen Should Be Thoroughly Sterilized with 4 Per Cent Caustic Soda.

Colostrum Feeding

- Colostrum Is the First Milk Secreted after Parturition.
- It Contains Large amount of Gamma Globulins Which are antibodies Produced by the Cow against antigens Encountered During Her Life including Those against Human Disease Producing organisms.
- Absorption of these antibodies Provides the Calf with an Umbrella of Passive Immunity.

Composition of Colostrum and Milk

- Colostrum Is a Highly fortified Source of Nutrient Having 7 Times the Protein and Twice the total Solids of Normal Milk, Thus Giving an Early Boost in Portion and Solid intake.
- It Contains Higher amount of Minerals and Vitamin a Which are Essential to Combat Diseases. ingestion of Colostrum Substantially increases the Calf's Survivability.
- Colostrum Gives a Laxative Effect Which Is Helpful in Expulsion of Meconium (First Faeces of New Born Calf).
- The Cows Should Be Vaccinated against Contagious and infectious Diseases Which Help to increase the Quantity and Quality of Gamma Globulins in Colostrum.
- Similarly, Colostrum of Mature Cow Possesses Large Quantities of Gamma Globulins Because they Have Greater Chance of Exposure to Many infections.
- The Gamma Globulins Must Be absorbed as Such across the intestinal Wall into Blood Stream without Being Broken Down into the Constituent Peptides or amino acids.
- This Permeability Is Rapidly Lost after the First Few Hours of Life. Many Studies Have Shown That these Globulins Pass across the Gut Wall at the Most Rapid Rates During the First 1-2 Hours of Life.
- Taking This into View. It Will Be Highly Useful to Feed Colostrum in the First 15-30 Minutes Followed by a Second Dose in approximately 10-12 Hours after Birth.
- The absorptive Cells(Enterocytes) Lining the Small intestine are Immature at Birth. in This Stage they indiscriminately Take Up Large Molecules Like Immunoglobulins.
- As the Calf Grows Older Hour by Hour, there Is a Transition of Epithelial Cells of Small intestine from Immature Type to Mature Type Which Will Not allow Large Protein Molecules.
- As More and More Cells Mature, the Capacity of the Calf to absorb Immunoglobulins Diminishes Proportionately Until No More absorption Can Take Place.

This Phenomenon Is Called 'Gut Closure'. Concentration of antibodies at 'Closure' Is Directly Related to the Disease Resistance of the Calf.

- If at Closure the Calf Had absorbed only a Small Number of Immunoglobulins from Colostrum, the Diminishing Concentration Soon Pushes the Calf into a Critical Immune Position.

This increases Morbidity and often Leads to Mortality of the Calves.

Quality and Quantity of Milk Feeding

The First Portion of the Colostrum Should Be Given to the Calves within one Hour of Birth, the Further Delay to This Can increase the Risk of Mortality and Susceptibility to Diseases. Second Feeding Should Be Done within 12 Hours and Third Feeding within 24 Hours. the Calf Should Be Given approximately 1 Litre of Colostrum in Each Feeding.

The Quality of the Colostrum Plays a Significant Role in the amount of Colostrum to Be Given in the First Portion, Usually a Good to Very Good Quality of Colostrum Containing 100 to 200 Grams of Immunoglobulin Should Be Fed. Good Quality Colostrum Should Have a Brix Measurement of More Than or Equal to 22. It Is Found That Feeding the Calves after Birth Can Significantly Improve the Passive Immunity Transfer and the Calf Needs Colostrum of Good Quality for Efficient absorption of Immunoglobulins. If the Colostrum Is of Poor Quality, then

the Calf Should Be Given Calf Colostrum Replacers as an alternative artificial Colostrum for Calf. Thus, a Good Quality of Colostrum Plays a Vital Role in the Successful Transfer of Passive Immunity to Ensure Reduced Risk of Mortality, Improved Rate of Gain, and Overall Development, So It Is Recommended to Feed the Calf with Colostrum Up to Three Weeks of age.

- Quantity of Colostrum to Be Fed Is 1/10th of Body Weight of the Calf.
15-30 Minutes of Life - 5-8 % of Body Weight
- 10-12 Hours of Life - 5-8 % of Body Weight
- 2nd Day - 10% of Body Weight
- 3rd Day - 10% of Body Weight
- Excess Colostrum Can Be Milked Out Daily Otherwise the Calves Can Drink in Excess and Results in Calf Scour.
- The Excess Colostrum Can Be Stored by Refrigeration and Can Be Used to Other Calves or orphan Calves.
- Colostrum Can also Be Frozen and Stored indefinitely. Colostrum Can also Be Fermented Naturally and Stored for 5-7 Days and Can Be Used.
- Colostrum Substitute: in Case of Non-Availability of Colostrum Due to accidental Death of Mother or agalactia, Colostrum Substitute Can Be Used.
- It Can Be Prepared by Mixing 2 Whole Eggs in one Litre of Milk and 30 MI of Castor Oil. It Should Be Fed Three Times in a Day.

Constituents	Colostrum of Cow Milk	Colostrum of Buffalo Milk	Milk
Total Solids	28.30	31.0	12.86
Ash	1.58	0.9	0.72
Fat	0.15-1.2	4.0	4.0
Lactose	2.5	2.2	4.8
Casein	4.76	7.7	2.8
Albumin	1.5	3.6	0.54
Globulin	15.06	12.5	-
Total Protein	21.32	23.8	3.34

Milk Replacers

- Milk Replacers or Milk Substitutes Consist Basically of Skim Milk Powder and Lard or Vegetable Fat, although a Proportion of Butter Milk Powder and Whey Powder Is often included.

- A Small Proportion of Glucose, Soybean Flour and Cereal Flour May also Be added together with Certain Minerals and Vitamins.
- If Good Quality Milk Replacer Is Used, there Is No Need for Feeding any Whole Milk after the Colostrum Feeding.

General Characteristics of Good Quality Milk Replacers

- Contains Minimum 50 Per Cent Spray Dried Skim Milk Powder
- Contains 10-15 Per Cent Stabilized High Quality Fat, Mainly Lard Homogenized into Skim Milk or Butter Milk Before Spray Drying.
- Supplemented with Vitamin a, E and B12.
- Incorporated with antibiotic Feed additives.
- Should Contain 22-25 Per Cent Good Quality Protein.
- Should Not Contain Starch or Fibre.
- Should Be Readily Dispersible in Water.
- Should Flow Well as a Powder for automatic Feeding Equipment.
- Milk Replacer Should Be Mixed in Correct Proportion in Warm Water, Since Dilutions Which are too Weak or too Strong Tends to Create Digestive Problems.
- Optimum Ratio of Milk Replacer (Kg) and Water (Litre) Is 1: 8.
- Good Milk Replacer Composition Should Contain Spray Dried Skimmed Milk Powder of 50 Parts, Dried Whey of 10 Pars and Non-Milk Source of 40 Parts.
- A Good Milk Replacer Is as Follows,

Item	Amount in Kg
Dried Skim Milk	70
Dried Whey	18
Lecithin	2
Animal Fat	10
Dicalcium Phosphate	1.7
Copper Sulphates, Ferrous Sulphates, Manganese Sulphates, antibiotic	Traces

Partial Milk Replacers

The Difference Between Partial Milk Replacer from Milk Replacer Is That It Does Not Contain High Proportions of Milk or Skim Milk Powder.

An Example of a Partial Milk Replacer Is

Components	Parts
Wheat	10
Linseed Meal	40
Milk	23
Coconut Oil	10

Butyric acid	0.3
Citric acid	1.5
Mineral Mixture	3.0
Antibiotic	0.2
total	100

Calf Starter

They are First-Day Concentrate Mixture Fed to Calves. Calves Start Eating Small amount of Dry Starter from the 2nd Week of Life. to Train them to Eat Starter Mix, the Following Procedure May Be Useful.

- A Calf Starter Should Be Highly Palatable.
- It Should Contain High Energy (75% Tdn) and 14-16 Per Cent Digestible Crude Protein.
- Calf Starter May Be Fed on Free-Choice Basis Until the Calf Starts Consuming about 1-1.5 Kg of the Starter Mix a Day, after Which the amount May Be Restricted.
- Generally, Calves Reach This Stage by 2 ½ Months to 3 Months of age.
- Milk Feeding Can Be Discontinued Early If the Calf Is Consuming 0.4-0.5 Kg of Concentrate Per Day Depending Upon the Breed. a Great Variety of Calf Starters are available.
- The Constituents of Calf Starter May Be altered according to the availability of Feed in the Region and Cost.

Composition of Calf Starter

Ingredients	Parts
Maize	42
Gnc	35
Wheat Bran or Rice Bran	10
Fish Meal	10
Mineral Mixture	2
Salt	1

6. ANIMAL WELFARE MEASURES IN DAIRY FARMING

6.1 Checklist for animal Health Management

The Welfare of the Dairy animals Is always Considered to Be Very Important and Ensured That top Priority Is Given. the Welfare of animals Is Directly Related to the Five Freedoms as Given Below:

- i) Freedom from Thirst, Hunger, and Malnutrition
 - Provide Sufficient Feed and Water for all animals Every Day
 - Adjust Stocking Rates and/Or Supplementary Feeding to Ensure adequate Water, Feed and Fodder Supply
 - Protect animals from toxic Plants and Other Harmful Substances
 - Provide Water Supplies of Good Quality That are Regularly Checked and Maintained
- ii) Freedom from Discomfort
 - Design and Construct Buildings and Handling Facilities to Be Free of Obstructions and Hazards
 - Provide adequate Space allowances and Clean Bedding
 - Protect animals from adverse Weather Conditions and the Consequences thereof
 - Provide Housed animals with adequate Ventilation
 - Provide Suitable Flooring and Footing in Housing and animal Traffic areas
 - Protect animals from injury and Distress During Loading and Unloading and Provide appropriate Conditions for Transport
- iii) Freedom from Pain, injury, and Disease
 - Have an Effective Herd Health Management Programme in Place and inspect animals Regularly
 - Do Not Use Procedures and Practices That Cause Unnecessary Pain
 - Follow appropriate Birthing and Weaning Practices
 - Have appropriate Procedures for Marketing Young Dairy animals
 - Protect against Lameness
 - Milk Lactating animals Regularly
 - Avoid Poor Milking Practices as they May injure Dairy animals
 - When animals Have to Be Euthanized on-Farm, avoid Unnecessary Stress or Pain
- iv) Freedom from Fear
 - Consider animal Behaviour When Developing Farm Infrastructure and Herd Management Routines.
 - Provide Competent Stock Handling and Husbandry Skills and appropriate Training

- Use Facilities and Equipment That are Suitable for Stock Handling
- v) Freedom to Engage in Relatively Normal Patterns of animal Behaviour
- Have Herd Management and Husbandry Procedures That Do Not Unnecessarily Compromise the animals' Resting and Social Behaviours.

Checklist for Dairy Farms

The Following Is a Checklist to Help Dairy Farms Understand and Prepare their Farm Protocols and Procedures. there are 3 Levels of action:

Immediate (I), Mandatory (M) and Continuous (C).

Immediate action (I) - Requires That the Standard Is Met Immediately. the Facility Compiles with the Ban on Routine Tail Docking. (I)

- Mandatory action (M) - Requires That the Standard Is Met within Nine (9) Months or Less.
- Veterinary involvement - Do You Have a Signed Veterinary-Client-Patient Relationship annually with Your Vet? (M)
- Has Your Veterinarian Reviewed and Signed off on Your Written Herd Health Plan annually? (M)
- Has Your Veterinarian Reviewed and Signed off on Your Written Treatment Records annually? (C)
- Animal Care and Continuing Education
- Annual Signed Cow Care agreement for any Non-Family Employees with animal Care Responsibilities (M)
- Continuing Education – annual Continuing animal Care and Handling Education for Non-Family Employees with animal Care Responsibilities Like - Pre-Weaned Calf Care; Non-Ambulatory animals; Euthanasia; Determining animals are Fit to Transport (M)
- Herd Health Plan Components

Pre-Weaned Calf Protocol and Practices (M)

- Facilities are Designed to Have a Calving area That Is Clean, Soft, Dry, Well-Lit and Well-Ventilated.
- All Pre-Weaned Calves are Moved by Lifting, Walking or the Use of Clean, Properly Designed Mechanical Transport Devices. (M)
- All Pre-Weaned Calves (Heifers and Bulls) Receive Colostrum or Colostrum Replacer within 6 Hours after Birth, Even If Immediately Transported off the Farm. (M)
- All Pre-Weaned Calves (Heifers and Bulls) Receive a Volume of Milk or Milk Replacer to Maintain Health, Growth and Vigour Until Weaned or Marketed. (M)
- All Pre-Weaned Calves (Heifers and Bulls) are offered Fresh, Palatable Starter Feed by Day 3 to Maintain Health, Growth and Vigour. (M)

- All Pre-Weaned Calves (Heifers and Bulls) Have access by Day 3 to Clean, Fresh Water appropriate for Climatic Conditions. (M)
- All Calves are Disbudded Before 8 Weeks of age. (M)
- Pain Mitigation for Disbudding Is Provided. Pain Mitigation Is Expected to Be Used When Disbudding Calves for any Method (Cautery, Paste, Etc.). It Is Expected That Producers Work with their Veterinarians to Determine the appropriate Pain Mitigation to Use for Disbudding. (C)

Non-Ambulatory animal Protocol and Practices (M)

- The Written Herd Health Plan Has a Written Protocol for Non-Ambulatory animal Management That includes Language Specific to areas of Non-Ambulatory animal Management.
- Facilities are Designed to Have a Location to Segregate Weak, Sick or injured animals.
- The Location for Weak, Sick or injured animals Provides animals: Feed, Water, Protection from Heat and Cold for Typical Climatic Conditions, Isolation from Other ambulatory animals and Protection from Predators. (M)
- Non-Ambulatory animals are Moved Using Proper Methods including the Use of Special Equipment. (M)
- Non-Ambulatory animals are Provided Prompt Medical Care. (M)

Fitness to Transport Protocol (M)

- The Facility Has an Effective Written Protocol for Fitness to Transport That includes the Definition of animals That are Eligible to Be Marketed. (M)
- Outlines adherence to Milk and Meat withdrawal Times. (M)

Euthanasia Protocol and Practices (M)

- Criteria Used to Identify animals That are to Be Euthanized and Outlines the Immediate action of Euthanasia When the Criteria are Met. (M)
- Euthanasia Techniques Follow the approved Methods. (M)
- Carcass Disposal Is Conducted Using the appropriate Method in accordance with applicable Local ordinances. (M)

Treatment of Common Diseases Protocols

- Mastitis
- Displaced abomasum
- Metritis
- Pneumonia
- Milk Fever
- Diarrhoea
- Ketosis

Lameness – Prevention and Treatment Protocol

- Routine Surveillance for Lame Cows with Prompt, Effective Treatment
- Routine Use of Foot Baths
- Improved Flooring
- Providing adequate Time for Daily Rest by Minimizing Time Out of the Pen to Less Than 3 Hours Per Day
- Avoid Overstocking
- Maintaining thermal Neutral Zone
- Preventive Hoof Trimming

Milking Procedure Protocol

- Cows Should Be Moved without Excessive Vocal or Physical interaction, Resulting in Calm Movement in the Parlour.
- Animal Handlers Should Walk against the Flow of Cows Coming into the Parlour, Paying attention to the Reaction of the Cattle and adjust for Balking or Stopping. to Return to their Starting Positions, animal Handlers Should Use a Path That Does Not Impede the Flow of Cattle Movement.
- Gates and Restraining Equipment Should Operate Smoothly, Quietly and Safely.
- Goal for Time Out of Pen for Each Milking <1 Hour.
- Holding area Control to Prevent injuries and Ensure Cow Comfort (Flooring, Fans, Sprinklers, Etc.)
- Milking Preparation Routing
- Maintenance of Milking Equipment.

Emergency action or Crisis Plan

- The Facility Has Names, Telephone Numbers and the Site address Posted in a Prominent Location, in the Languages Understood by Family and Non-Family Employees with animal Care Responsibilities, for Emergency Preparedness.
- The Facility Has a Written Emergency action/Crisis Plan to Effectively Manage Emergencies or Crises That May Occur. Plans Should include:

➤ Identification of Potential Emergency Situations

the Following Components for Each Potential Emergency Situation:

actions to Take in an Emergency Situation

1. Designated People in Charge of Performing Those actions
2. Individuals Given authority to Perform Specific action When Emergency Occurs
3. Communication Flow for Quick and accurate information Share
4. Data and information Related to: Site, Utilities, Evacuation Routes, Road Condition, Equipment/Materials involved, injuries and Locations of Resources
5. Emergency Supplies and Equipment
6. Training and Documentation of the Training on the Execution of the Emergency Plan for all involved including Employees and First Responders

7. Response Scenarios Options
8. Sheltering in Place

Difficulty Calving (Dystocia) Protocol

- When to intervene
- Appropriate Equipment to Use

6.2 Transport of animals

General Conditions for Transport of animals

- Healthy animals Should Be Transported and a Qualified Veterinarian Should Certify It.
- Young animals Should Be Separated from adult animals and advanced Pregnant State animals Should Be Separated from Other animals.
- When animals are Transported from Endemic area, Necessary Permission Should Be Obtained from Concerned authorities for Proper Health Condition.
- 14 Days Prior to Transportation Necessary Vaccination Procedure Should Be Completed for the Particular Livestock.
- During Transport all the Livestock Should Be Given Humane Treatment.
- Sufficient Quantity of Feed and Fodder Should Be Carried During Transport.
- The Vehicle Should Be Examined for Cleanliness, the Floor and Walls Shall Be Undamaged and Should Be Free from Nails and Other Sharp Edges.
- The Vehicle Should Be Sprayed with Disinfectant Solution.
- Materials for Bedding Such as Straw or Hay Should Be Placed on the Floor to avoid injury and the Bedding Should Not Be Less Than 5 Cm Thickness.
- Animals During Transport Should Not Be Tied Up at Leg.
- Each Consignment Shall Bear a Bold Red Label Showing the Following Particulars.
- Number and Kind of animals Loaded.
- Name and address and Telephone Number of the Consignor (Sender) and Consignee (Receiver).
- Quantity of Ration to Be Fed.
- Consignee Should Be informed about the Train or Vehicle in Which the Consignment of Cattle Is Sent and Its arrival Time in advance.
- In Case of Journey for More Than 12 Hours an attendant Should Be Present at all the Time and Should Ensure the Proper Conditions are Maintained During Transport.
- Cattle, Sheep and Goat Should Be Unloaded by Every 8 Hours and Should Be Watered. the attendant Should Not Permit the Sheep and Goat to Sit Down During Transit.
- Apart from the above General Condition Some Species of Livestock Require Specific Conditions for Transport and It also Depends Upon the Mode of Transport.

Transport of Cattle

It Must Be accompanied with a Valid Health Certificate indicating Fitness of the animals for Transport and their Selves Being Free from any Contagious or infections Disease and in the absence of This Certificate, the Carrier Shall Not accept the Consignment; the average Space Provided Per Cattle in Railway Wagon Vehicle Shall Not Be Less Than Two Square Meters; Hungry and Thirsty Cattle Should Not Transported; Cattle in advanced Pregnancy Shall Not Be Mixed with Young Cattle to avoid Stampede During Transportation .

Transport of Cattle by Train

- The average Space Provided Per Cattle in Railway Wagon or Vehicle Shall Not Be Less Than Two Square Metres.
- Suitable Rope and Platforms Should Be Used for Loading Cattle from Vehicles.
- In Case of Railway Wagon the Dropped Door of the Wagon May Be Used as a Ramp When Loading or Unloading Is Done to the Platform.
- Cattle Shall Be Loaded after they are Properly Fed and Given Water.
- Cattle in advanced Stage of Pregnancy Shall Not Be Mixed with Young Cattle in order to avoid Stampede During Transportation.
- Watering arrangements on Route Shall Be Made and Sufficient Quantities of Water Shall Be Carried for Emergency.
- Sufficient Feed and Fodder with adequate Reserve Shall Be Carried to Last During the Journey. adequate Ventilation Shall Be Ensured.
- When Cattle are to Be Transported by Rail, an ordinary Goods Wagon Shall Carry Not More Than Ten adult Cattle or Fifteen Calves on Broad Gauge, Not More Than Six adult Cattle or Ten Calves on Metre Gauge, or Not More Than Four adult Cattle or Six Calves on Narrow Gauge.
- Every Wagon Carrying Cattle Shall Have at Least one attendant. Cattle Shall Be Loaded Parallel to the Rails, Facing Each Other.
- Rations for Padding, Such as Straw, Shall Be Placed on the Floor to avoid injury If Cattle Lie Down and This Shall Not Be Less Than 6 Cm Thick.
- Rations for the Journey Shall Be Carried in the Middle of the Wagon.
- To Provide adequate Ventilation, Upper Door of one Side of the Wagon Shall Be Kept Open Properly Fixed and the Upper Door of the Wagon Shall Have Wire Gauge Closely Welded Mesh arrangements to Prevent Burning Cinders from the Engines Entering the Wagon and Leading to Fire Outbreak. Cattle Wagons Should Be attached in the Middle of the Train.
- Two Breast Bars Shall Be Provided on Each Side of the Wagon, one at Height of 60 to 80 Cm and the Other at 100 to 110 Cm.
- Cattle-In-Milk Shall Be Milked at Least Twice a Day and the Calves Shall Be Given Sufficient Quantity of Milk to Drink.
- As Far as Possible, Cattle May Be Moved During the Nights only. During Day Time, If Possible, they Should Be Unloaded, Fed, Given Water and Rested and If in Milk, Milking Shall Be Carried Out.

Transport of Cattle by Road or Truck

- Transport by Road or Truck Has the Convenience of Loading at the Farm and Direct Transit to the Point of Market.
- The absence of Repeated Handling and Disturbance associated with It and Consequent avoidance of Serious Weight Loss.
- But the Poor Road Condition and Longer Distance to Be Travelled Cause Comparatively Higher Cost Per Km Than Rails.
- When Cattle are to Be Transported by Goods Vehicle the Following Precautions are to Be Taken Namely
- Specially Fitted Goods Vehicles with a Special Type of Tail Board and Padding around the Sides Should Be Used.
- Ordinary Goods Vehicles Shall Be Provided with anti-Slipping Material, Such as Coir Matting or Wooden Board on the Floor and the Superstructure, If Low, Should Be Raised.
- No Goods Vehicle Shall Carry More Than Six Cattle.
- Each Goods Vehicle Shall Be Provided with one attendant.
- While Transporting, the Cattle, the Goods Vehicle Shall Not Be Loaded with any Other Merchandise and
- To Prevent Cattle Being Frightened or injured, they Should Preferably, Face the Engine.

7. MILK PROCUREMENT – TESTING THE MILK TO ASSESS THE FAT AND SNF

Milking Is the Defining activity of Dairy Farming. Milking Management aims to Minimize Microbial, Chemical, and Physical Contamination. Milking Management Covers all aspects of the Process of Obtaining Milk from animals Quickly and Effectively, While assuring the Health of the animals and the Quality of the Milk.

Consistency in the Day-To-Day Implementation of Milking Procedures Is an Important Part of Good Dairy Farming Practice for Milking.

The Suggested Good Dairy Farming Practices for Milking Hygiene are Set Out Under the Following Headings:

- Ensure Milking Routines Do Not injure the animals or introduce Contaminants into Milk
- Ensure Milking Is Carried Out Under Hygienic Conditions.
- Ensure Milk Is Handled Properly after Milking.

7.1 Purpose of Clean Milk Production

- To Produce Safe Milk
- Pathogens Free
- Milk with Low Bacterial Count and Somatic Cell Score

Clean Milk Produced Is always Tested for Its Quality, the Fat and Snf Contents Which Defines the Cost of the Milk Per Litre.

7.2 Clean Milk Production

Packages of Hygienic Practices at the Farm Level

- a) Animal Hygiene
- b) Milker's Hygiene.
- c) Utensil- Equipment Hygiene
- d) Hygiene During Milking Process.
- e) Environmental Hygiene.

7.3 animal Hygiene

I) animal Health

- Periodical Examination of Milch animal for Udder and Other Disease. Check the Udder and Teats for any abnormalities Which May indicate Clinical Mastitis.
- Treatment of infected animals
- Isolation of infected ones
- Adoption of Sanitary Precautions
- Milk of infected animal Should Not Be Mixed with the Bulk Supply Until the animal Is Fully Recovered.

ii) Cleanliness of Udder and Body

- The Body and Udder of the animal Should Be Cleaned Before Milking by Washing and Dried by Wiping with a Clean Cloth.
- While Washing and Wiping Care Should Be Taken Not to Damage the Teat orifice and Cleft Between the Quarters of the Udder
- Clean Water Should Be Used.
- Preliminary Washing with ordinary Water Secondary Washing with Clean and Luke Warm Water (Temperature <50 Degree C)
- Sodium Hydrochloride Solution or Chlorinated Water Should Be Used.
- Use of Soap for Udder May Help in Cleaning But Not on Microbes
- Drying with a Clean Cloth Is Essential.

7.4 Milkers Hygiene

- Persons Milking the animals Should Take Care of Following Points for them to avoid Contamination of Milk.
- To Be Free from infectious Disease
- Avoid Coughing & Sneezing Over the Milk Pales
- Hands to Be Cleaned with Water & Soap Before Milking.
- Nails to Be Cut Regularly Since May Harbour Some infectious organism
- Nails May also Cause injury to the Teats.

7.5 Utensils or Equipment Hygiene

Pails or the Other Containers Used for Milking and Storage of Milk Under Farm Condition Play a Significant Role in Determining the Microbiological Quality of Milk. Following Measures Need to Be adopted

- Milk Producer Should Be advised to Use Clean and Tinned Utensils Having Smooth Surface, Free from Dent and Cervices for Milking and Storing of Milk.
- Milk Pails - Buckets or Other Utensils Should Be Cleaned with Detergent Sanitiser and Properly Rinsed with Water Immediately after Use Rinsing with Boiling Water or Use of Detergent & Sanitizers May Be Practiced.
- Incase of Milking Machines Regular Washing of Metallic Parts & Rubber Parts Should Be Done. for Rubber Parts –0.4 to 0.5% Lye Solution Should Be Used.
(Lye Solution – Naoh (0.4- 0.5%) Cip: - This Is Preferred for Cleaning of the Pipelines of the Milking Equipments)

7.6 Hygiene During Milking Process

- Complete Milking I.E., No Milk Should Be Left inside the Udder after Milking Elimination of Poor Quality Milk Because This Is High in Bacterial Count Which Get Mixed with Subsequent Milk Lot and Raised Over all Bacterial Number in Milk.
- Dry Milking — It Is Preferable Over Wet Milking, Wet Milking increases the Bacterial Number in the Milk by Dripping by Washing Down of foreign Matter of Teats and Dirt'S on Milkers Hands in to the Milk.
- Milking by Full Hand Method Is Good and Not by Knuckling Method.

7.7 Environmental Hygiene

- Place Where Housing, Feeding, and Milking of animal Is Done Should Be Clean and Hygienic with Respect to aeration, Humidity, Lighting, Floors, Wall Ceiling, insect'S Etc.
- Following Points to Be Kept in Mind: -
 - Separate Premises Located Far away from the Human Living Quarters, Sewage, Manure Pits and Stagnant Water Pools are advisable for Housing and Milking of animals.
 - Proper Ventilation
 - Avoiding Direct air Currents and Dust in the Cow Shed and Milking byre.
 - Ample Sunlight
 - Dry Bedding of animals.
 - Tick Free Bedding

7.8 Important Tips While Milking

Institute Regular Milking Times and Routines

Milk animals Regularly Using Consistent Milking Techniques. Ensure Good Milking Technique Is Consistently applied. incorrect or Variable Milking Techniques Can Result in a Higher Mastitis Risk and injury to the animal.

The Correct Technique for Machine Milking Is to:

- Prepare animals Properly Before Milking;
- Attach the Cups to Clean, Dry Teats;
- Avoid Unnecessary air ingress at Cup attachment;
- Avoid Over Milking;
- Remove Cups Gently; and
- When Necessary, apply Teat Disinfectant to Each Teat after Milking according to National Recommendations and Regulations.

The Correct Technique for Hand-Milking Is to:

- Restrain the animal to Be Milked Using a Method That Does Not Cause Pain or injury;
- Ensure the Milker's Hands are Clean and Dry;
- Prepare the Teats for Milking, Ensuring they are Clean and Dry;
- Only Use appropriate Teat Lubricants according to National Recommendations and Regulations;
- Handle the Teats Gently, Ideally Using the 'Fist-Grip' Method, avoiding any Discomfort, Pain or injury to the animal;
- Use Buckets That are Non-Corrosive, Easy to Clean and Disinfect, and Do Not Taint the Milk;
- Avoid Contaminating the Collected Milk with foreign Material Such as Dust, Dirt, Soil, Urine, Manure (Dung) and Protect It from Flies; and
- When Necessary, apply Teat Disinfectant to Each Teat after Milking according to National Recommendations and Regulations.

Segregate Milk Harvested from Sick or Treated animals for appropriate Disposal

Animals Whose Milk Is Unfit for Human Consumption Should Be Milked Last or with a Separate

Bucket or System.

Store or Discard abnormal Milk in a Manner appropriate to the Risk Posed to People, animals and the Environment.

- i. Ensure Milking Equipment Is Correctly installed and Maintained
- ii. Ensure a Sufficient Supply of Clean Water
- iii. Ensure Milking Is Carried Out Under Hygienic Conditions
- iv. Ensure Housing Environment Is Clean at all Times
- v. Ensure Milking area Is Kept Clean
- vi. Ensure the Milkers Follow Basic Hygiene Rules
- vii. Ensure Milking Equipment Is Cleaned and When Necessary, Disinfected after Each Milking
- viii. Ensure Milk Is Handled Properly after Milking
- ix. Ensure Milk Is Cooled or Delivered for Processing within the Specified Time
- x. Ensure Milk Storage area Is Clean and Tidy
- xi. Ensure Milk Storage Equipment Is adequate to Hold Milk at the Specified Temperature
- xii. Ensure Milk Storage Equipment Is Cleaned and When Necessary, Sanitised after Each Milk Collection
- xiii. Ensure Unobstructed access for Bulk Milk Collection

8. SUSTAINABLE FARMS

Cow Dung, Excreta of Bovine animal, Is a Cheap and Easily available Bioresource on Our Planet. Many Traditional Uses of Cow Dung Such as Burning as Fuel, Mosquito Repellent and as Cleansing agent are already Known in India. Cow Dung Harbours a Diverse Group of Microorganisms That May Be Beneficial to Humans Due to their ability to Produce a Range of Metabolites. along with the Production of Novel Chemicals, Many Cow Dung Microorganisms Have Shown Natural ability to increase Soil Fertility Through Phosphate Solubilisation. Nowadays, there Is an increasing Research interest in Developing the applications of Cow Dung Microorganisms for Biofuel Production and Management of Environmental Pollutants.

8.1 Uses of Cow Dung

Biogas and Fuel

Dried Cow Dung Is an Excellent Fuel. in Some Cultures, Dung from Domestic Cows or Buffalo, after Being Mixed with Straw, Is Collected and Dried for Fuel. these Dried Pieces are Used as Fuel to Provide Heat and Flame for Cooking.

'Biogas' Is a Mixture of Gases That are Produced by anaerobic (Which Occurs in the absence of Oxygen) Digestion of organic Matter by Bacteria. organic Matter Can Be anything Like-animal Dung, Sewage, Plant Material, or Food Waste. the Device That Digests the Material Is Referred to as a Biogas Digester. the Gas Produced Can Be Used as Fuel.

Biogas – Production, and Uses

The General Process of Making an anaerobic Digester for Cow Dung Is by Placing Dung and Water in an airtight Container, Which Must Be Kept Warm and Undisturbed So That the Bacteria Can Do their Work. the Gas That Is Produced Is withdrawn Through a Tube and Stored. once Biogas formation Is Done, It Can Be Reacted with Oxygen to Produce Energy. the Gas Can Be Used to Cook Food, Heat Water, and Replace Conventional Fuel in Motor Vehicles. Moreover, the Energy in Biogas Can Be Used to Produce Electricity.

To Reduce Emissions of Greenhouse Gases, Related Global Warming, and Dependency on Fossil Fuels, It Is Very Important to Promote the Use of Renewable Energy, and in Many Parts of the World, in order to Reduce Green House Gases, they are Taking Efforts to Convert Biomass and organic Waste into Energy. Biogas Technology Plays a Vital Role in This, as Livestock Waste Is Considered to Be a Substantial Source of ambient Greenhouse Gases, Which Causes Climate Change. in Most Developing and Developed Countries, Bio Methanation Technology Has Been Promoted for the Same.

The Proper Management of Livestock Manure Has a Much Greater Potential to Reduce Methane Emissions, Especially in the Case of Cattle Manure. It Should Be Emphasized That Manure Stored in Piles Is a Source of Important Methane Emissions, the Scale of Which May Reach Tens of Thousands of tons Per Year.

Bio-Methanation Plant

Biogas Plants Can Be Designed and Constructed as Per the Requirement, Depending Upon the amount of and the Type of Waste available and the amount of Gas Needed.

The Unprocessed Cattle Dung or Burning of the Cattle Dung Is More Dangerous as It Emits Greenhouse Gases and Carbon Dioxide and Thus Polluting the Environment. Whereas the

Combustion of Biogas Provides a Clean Source of Energy, as It Does Not Produce Soot, Like Firewood. This Helps Reduce indoor air Pollution, Which in Turn Prevents Respiratory infections and associated Diseases. It Can Be a Good alternative to Lpg Which Is Getting Costlier.

Biogas Plants Significantly Curb the Greenhouse Effect: the Biogas Plants Lower Methane Emissions by Capturing This Harmful Gas and Using It as Fuel. Biogas Generation Helps Cut Reliance on the Use of Fossil Fuels, Such as Oil and Coal, the Most Important of Its Many advantages Is That Biogas Can offer a Decentralized Energy Solution.

8.2. Collection of Cow Dung (Manure) and Cleaning by Washing

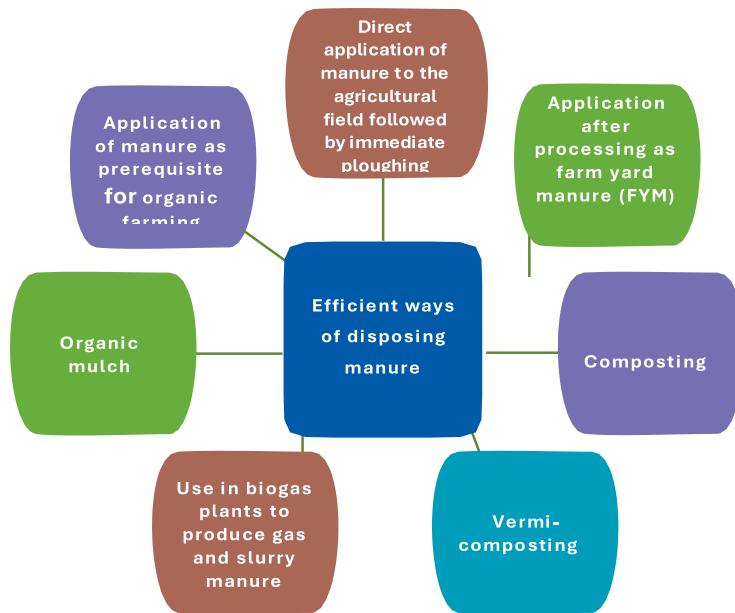
Solid Manure Is Usually Collected and Removed from the animal Shed, and the Floor of the animal House Is Flushed. Semi-Solid and Liquid Manure Is Removed with the Help of a Water Hose Pipe. Solid Waste from Livestock Farm Is Dumped in the Manure Pit. these Wastes are Gradually Changed into Manure by the Bacterial activity after Few Months.

The Manure Pit Is about 100 Metres away from the animal Shed and Other Structures. It Helps in avoiding Foul Smell originating from the Manure Pit and Safeguards against Flies and insects. Manure Pits are Easily accessible from Different Parts of the Farm. they are Placed Far from the Water Source. a Roof May Be Provided Over the Pit to Protect It from Rain.

The Liquid Manure Can also Be Flushed Through a Shallow Drain Located Longitudinally to the Longer axis of the animal House. Each Shallow Drain of the Shed Is Connected to the Sub-Drain and Subsequently to the Main Drain. the Main Drain Is Finally Connected to the Liquid Manure Storage Tank, or the Same Can Be Treated by Effluent Treatment Plant. the Treated Water Is Reused for agricultural Crops.

8.3 Effective Disposal and Utilization of Manure

There are Various Methods for Handling and Treating animal Waste. Methods That are available for applying animal Excreta into the Soil include:



8.4 Economic Viability

Generally Setting Up Biogas Plants Is Considered Expensive, to Promote and Support Sustainability, Government of India Is Supporting by Providing Subsidies for Setting Up Biogas Plants, Which May Range from Rs.25000 to 5cr, and the Payback Period of a Biogas Plant Is Generally Considered to Be 3-4yrs. Besides Supplying Energy and Manure, It Provides an Excellent Opportunity for Mitigation of Greenhouse Gas Emissions and Reducing Global Warming and thereby Earning Carbon Credit, Which in Turn Can Be Encashed on a Yearly Basis, Thus Making Biogas Plants Economically Viable.

I. Biogas as an alternative to Lpg for Cooking

As the Price of Conventional Cooking Gas (Lpg), Is Constantly increasing and Becoming Unaffordable for the Major Population, the Gas Produced from the Biogas Plant Can Be Used as an alternative and Thus affordable, as the Gas Is Produced by the Digestion of Cattle Dung, It Is More Economical and Environment Friendly.

ii. Biogas as an alternative to Electricity

The Expenses on Power Used in a Dairy Processing Unit are So Huge as they Must Food Processing Units, and Other Major Electrical appliances, the Major Expenses on the Electricity Can Be Reduced by Converting the Biogas Produced to Electricity by installing a Biogas Genset.

iii. Biogas as an alternative for Pollution-Free Fuel

If the Biogas Produced from the Dairy Farm Which May include the Cattle Dung and any organic Wastes Generated in the Farm, Is Considerably High, It Can Be Further Purified to Cbg (Compressed Biogas), Which Is Equivalent to Cng (Compressed Natural Gas) and Can Be Used in Vehicles or Filled in Cylinders and Sold to Restaurants and Other industries.

iv. Nutrient Rich Bio-Manure and Other Bioproducts

The Slurry That Is Produced Post the anaerobic Digestion Process, Is Considered Black Gold as It Is Very Much Rich in Nitrogen, Phosphorus, and Potash, a Very Good Fertilizer That Can Be Sold to Farmers.

Table – I Composition of Biogas Slurry/Vermicompost/ Cow Dung

Slurry Type	Nitrogen (%)	Phosphorus (%)	Potash (%)
Digested Slurry	1.5 – 2.0	1.0	1.0
Vermicompost	0.5-1.5	0.1 – 0.30	0.15 – 0.56
Cow Dung	1.19	0.3	0.48

The Nutrient-Rich Bio Manure Can Be Further Processed into Phosphate Rich organic Manure (Prom), Which Can Be Used as an alternative to Dap (Di ammonium Phosphate) Fertilizer and Thus Maintain the Fertility of the Soil without adding any Chemicals.

The Electricity Produced, and the Sale of organic Fertilizers Either Raw Manure or Processed Manure as Prom are the Most Important Sources of income That are Expected from the Biogas System.

These Biogenerators Can offer Benefits to all Spheres of Society But are More Beneficial to Dairy Farms. they Can Use the Gas Produced for Cooking, Running Biogas Generators, and Fertilizing Crops with the Residual Waste or Sell them.

A Farm with 100 Cows Can Be Benefitted from the Following.

Biogas Produced	16kg/ Day
Annual Power Generation	60 Units of Power Per Day
Central Financial Subsidy	3.5 Lakhs (Approx.)
Carbon Credit Claim (Annually)	0.20 Lakhs
Bio Slurry Obtained (Annually)	2400 Kg/Yr.
Revenue Generated from Manure Sales (Cost @ Rs.1/ Kg)	Inr 24000/ Yr.
Value-Added Products from Bio Manure	
Prom	Inr 10/Kg. (Approx.)

Thus, Cow Dung Management Can Be Efficiently Handled Which Can Help the Farm Owners Benefit Economically and Contribute to the Reduction of GHG (Greenhouse Gases) and also Fall in Line with the Different Laws Imposed by the Pollution Control Board.

V. as a Building Material

Sometimes Cow Dung Is applied on the Floors of Rural Homes in India and May Be applied on the Walls as Well. the Mixture forms a Waterproof Layer That Helps to insulate the House from Heat Loss or Gain. a New Process Has Been Developed to Make Building Bricks from Cow Dung Mixed with Straw Dust. these Bricks are Much Lighter Than Conventional ones.

Manure Residue from Biogas Production Could Be Used instead of Sawdust to Make Fibre-Board, as It Contains Fibres. the Dung Is Sterilized and then Mixed with Resin to Make the

Board. This Board Has Many Uses Like Manufacturing Furniture and Floors in Homes, Etc. the High Fibre Content Enables Manufacturing of Paper from the Dung. the Dung Is Washed to Extract the Fibres, Which are then Pressed into Paper on a Screen. This Paper Can also Be Bought Commercially.

Vi. as an insect Repellent and a Disinfectant

When Cow Dung Is Burned, the Smoke That Comes Out Has Been Found to Repel insects, including Mosquitoes. This Characteristic Has Led to Its Use as an insect Repellent in Some areas.

Vii. as Fertilizer

It Is Important to Remove Cow Dung from Fields as Dried Pats Reduce Grazing area. also, Cow Pats Give off Methane, Which acts as a Greenhouse Gas in the atmosphere. Water Run-Off Carries Some of the Dung into Rivers and Other Bodies of Water, Polluting them with Nutrient Excess. Cow Manure Can Make Good Fertilizer and Is Rich in Minerals, Especially Nitrogen, Phosphorus, and Potassium. It Supports the Growth of Beneficial Microorganisms When It Is Mixed with Soil. It Can also Improve the Texture of Soil and Help It to Maintain Moisture. often, Manure Is too Rich in Certain Chemicals and Needs to Be Diluted or Left to Sit in the Soil for Some Duration Before Crops are Planted.

8.5 Farm Yard Manure (Fym)

When a Mixture of Dung and Urine of Farm animals and Leftover Feed and Fodder Is allowed to Decompose Slowly, the Resulting Product Is Called Fym. the Composition of Fym Depends on the Type of animals, their Ration, age, Species, Etc.

8.6 Composting

Composting Is the Process Whereby organic Matter Is Decomposed by Micro-Organisms. This Process Is in Practice for Centuries by Farmers Who Stock Dung into Piles or in Pits. Composting Can Be Either aerobic or anaerobic. the advantages of aerobic Decomposing are Shorter Stabilisation Time, No Foul Smell and Destruction of Weed Seeds and Pathogens.

During Composting, Temperatures Can Reach as High as 150°F, Whereas Most of the Pathogens Harmful to Humans are Destroyed at 131°F.

Composts Must Be Handled Carefully. an Unripe Compost Has a High Temperature Which Can Damage the Plants in Which It Is Put. Mature Manure Compost Is Safe to Use and Is the Best Type of organic Fertiliser. Older Composts Can Be Identified by their Colour and Moisture, a Black and Dry Compost Is Considered as Mature and a Yellowish and Wet Compost Is Not Suitable for Use in Plants.

8.7 Vermicomposting

The Term Vermicomposting Means the Use of Earthworms for Composting organic Residues. by the Process of Vermicomposting, the Earthworms Convert the organic Material into Humus-Like Material, and Process the Farm Waste Quickly and Efficiently.

Earthworms Consume all Kinds of organic Matter and Eat Equivalent to their Own Body

Weight Per Day; for Example, 1 Kg of Worms Can Consume 1 Kg of organic Matter Daily. the End-Product, I.E., the Vermicompost Is the Excreta of Earthworms Rich in Humus and Nutrients the Excreta (Castings) are Rich in Various Soil Nutrients Like Nitrogen, Potassium, Phosphorus, Calcium and Magnesium. Besides Converting the organic Waste into Valuable Manure, Earthworms Keep the Environment Healthy.

Dung Is Used as a Feedstock in Biogas Plants to Produce Gas and Slurry Manure. Biogas Is Non-Poisonous, with a Characteristic Odour, Which Disappears on Burning. When Mixed with air, It Burns with a Non-Luminous Blue Flame without Producing any Smoke. It Has a Very Low Level of inflammability. Biogas Is Used for Household Cooking, Lighting and Power. Special Lamps are available for Lighting Where Biogas Can Been Used. Combustion Engines, Commonly available, Can Be Run on Biogas. to Do This, a Special attachment Is Fitted to the Combustion Engine. Such attachments are Readily available. the Biogas-Spent Slurry Is Better Than Farm Yard Manure (Fym) Since It Is Well Digested and Has High Nutrient Contents.

8.8 organic Mulch

Mulch Is a Layer of Material applied to the Soil Surface. It Reduces Water Loss by Reducing Evaporation from the Soil. Mulch also Keeps the Soil Cooler, Reduces Weed Growth, Run-Off and Erosion. Manure Can Be Used as Mulch But are Best Mixed with Other Mulches, Especially If the Manure Is Fresh.

Thus the Manure Collected and Converted into Vermicompost or any Other Farm of Farmyard Manure or Slurry Is an income Source to the Farmer If Sold to Other Farmers or Even to Use It in His Own Field Would Fetch Better Yield and Better income.

The Utilization of Bio-Slurry Primarily are for Various Requirements associated with agricultural and animal Farming Requirements, Such as their Functions as Fertilizers and activator (Organic Fertilizer, Bio-Fertilizer, Bio activator, and Growth Regulator), Pesticides (Bio-Fungicides, Bio-Insecticides, and Seed Protector), Feed Stuff (Chicken, Duck, Fish, Rabbit, Earth Worm, and Eel), as Well as Culture Media (Hydroponic and Mushroom Cultivation). Numerous Benefits of Bio-Slurry Creates a Serious Potential for Productive Enterprises, Especially in Helping to Improve the Household Economic Prosperity.

To Establish an Efficient Manure Value Chain Fulfilling the Cooking Fuel Needs of Dairy Farmers and Providing them a Source of Stable income Through Sale of Bio Slurry While Helping in Mitigating adverse Climate Impact of Dairying. This Will Further Support in Manufacturing of Slurry-Based Bio Fertilisers and Selling them to Farmers at Reasonable Costs.

Aggregated Slurry Is Processed and Converted into fortified Solid (E.G. Phosphate Rich organic Manure) and Liquid Bio-Slurry(Different Grade Micronutrient, Growth Enhancers Etc.) Which Can Be Packed in a 5-Liter Capacity to Be Priced and Sold to Farmers.

8.9 Establishment of Biogas and Bio-Slurry Unit

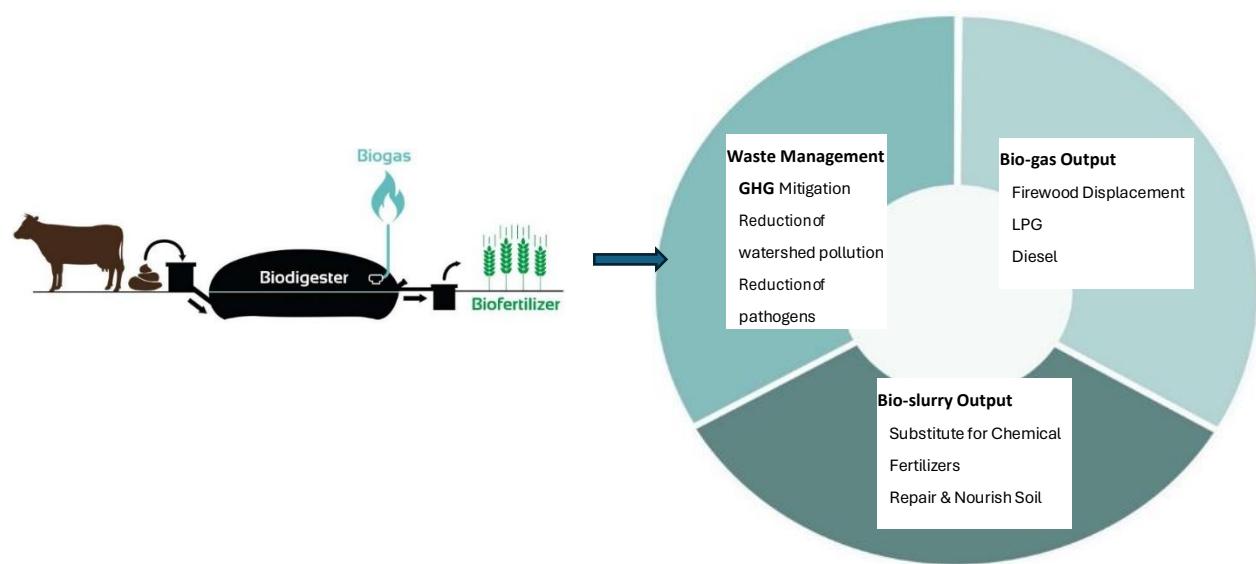
Bio-Slurry Is Used to Improve Soil Fertility, Soil Structure and Crop Productivity. It Can also Be an interesting Link Between the Biogas Programs aimed at Substituting Biomass Fuels for Cooking and Sustainable agriculture Promotion. Bio-Slurry Has So Many advantages That It Can Be Referred to as 'Bio Gold'.

Employment Opportunities also increase Through the Newly-Established Domestic Biogester Business Sector. It Contributes to a Cleaner indoor Environment as Well, as It Does Not Produce Smoke or Gas – Unlike Firewood and Dung

8.10 advantages of Biogas Production

- It Is a Eco-Friendly Fuel.
- The Required Raw Materials for Biogas Production are available abundantly in Villages.
- It Not only Produces Biogas, But also Gives Us Nutrient Rich Slurry That Can Be Used for Crop Production.
- It Prevents the Health Hazards of Smoke in Poorly Ventilated Rural Households That Use Dung Cake and Fire-Wood for Cooking.
- It Helps to Keep the Environment Clean, as there Would Be No Open Heap of Dung or Other Waste Materials That attract Flies, insects and infections
- Availability of Biogas Would Reduce the Use of Firewood and Hence Trees Could Be Saved.

Biogester Is Designed to Meet all Present and Future Needs of the Farmer



8.11 Components of Biogas Plants

- Mixing Tank – the Feed Material (Dung) Is Collected in the Mixing Tank. Sufficient Water Is added and the Material Is Thoroughly Mixed Till a Homogeneous Slurry Is formed.
- Inlet Pipe – the Substrate Is Discharged into the Digester Through the inlet Pipe/Tank.
- Digester – the Slurry Is Fermented inside the Digester and Biogas Is Produced Through Bacterial action.

- Gas Holder or Gas Storage Dome – the Biogas Gets Collected in the Gas Holder, Which Holds the Gas Until the Time of Consumption.
- Outlet Pipe – the Digested Slurry Is Discharged into the Outlet Tank Either Through the Outlet Pipe or the Opening Provided in the Digester.
- Gas Pipeline – the Gas Pipeline Carries the Gas to the Point of Utilization, Such as a Stove or Lamp.

Points to Be Considered for Construction of a Biogas Plant

8.12 Site Selection

While Selecting a Site for a Biogas Plant, Following aspects Should Be Considered

- The Land Should Be Levelled and at a Higher Elevation Than the Surroundings to avoid Water Stagnation
- Soil Should Not Be too Loose and Should Have a Bearing Strength of 2 Kg/Cm²
- It Should Be Nearer to the intended Place of Gas Use (Eg. Home or Farm).
- It Should also Be Nearer to the Cattle Shed/ Stable for Easy Handling of Raw Materials.
- The Water Table Should Not Be Very High.
- Adequate Supply of Water Should Be there at the Plant Site. the Plant Should Get Clear Sunshine During Most Part of the Day.
- The Plant Site Should Be Well Ventilated.
- A Minimum Distance of 1.5m Should Be Kept Between the Plant and any Wall or Foundation.
- It Should Be away from any Tree to Prevent Root interference.
- It Should Be at Least 15m away from any Well Used for Drinking Water Purpose.

8.13 Bio-Slurry

Anaerobic Digestion of Cow Dung Produces Two Main Outputs: Biogas and Bio- Slurry, the Digestate or Digester Effluent.

Anaerobic Digestion of animal Waste and Crop Residues Is a Widely Used Technology for Waste Management and the Production of Renewable Energy. the Process Leads to the Synthesis of Biogas That Can Replace Fossil Fuels and Contribute to the Mitigation of Climate Change. often Overlooked, But Not Less Valuable, Is the by-Product of This Process, the Digester Effluent or Digestate. This So-Called Bioslurry Has the Potential to Improve Soil Fertility and Soil Structure, to act as Pesticide and to Stimulate algal Growth in Ponds for Feeding Fish and Ducks. Small-Scale Farmers Throughout the World Use Biogas Digesters to Treat on-Farm Biowaste Such as Manure, Human Excreta or Plant Residues. When Mixed with Water, the organic Farm Residues Undergo an anaerobic Digestion Process. During the Process, Bacteria Transform the Biodegradable organic Compounds into Biogas, Nutrients, organic Matter and Other Substances Such as amino acids and Fats. in the First Stage of Digestion, Complex organic Compounds Such as Proteins, Fats and Carbohydrates are Broken Down and Dissolved by Microbial Enzymes. in the Second Stage, the Resulting Components are Further Converted to acetic acids, Hydrogen (H₂), Carbon Dioxide (CO₂) and Other Volatile

Fatty acids. in the Third Stage, Methane (Ch4), I.E. the Biogas and Other End Products are Produced.

These Mainly Non-Gaseous End Products Can Be Further Divided into:

- the Scum, Which Is the Solid Matter That Floats on the Surface of the Liquid Slurry;
- the Liquid Effluent, I.E. Bio Slurry, Which Retains a High Content of organic Matter (Om), Nitrogen (N), Phosphorous (P) and Potassium (K), as Well as a Range of Other Macro- and Micronutrients Like Calcium (Ca), Magnesium (Mg), Iron (Fe), Manganese (Mn), Zinc (Zn); and
- Solid Residues, Which Is the Matter on the Bottom of the Digester and often Called Sludge; It Contains a High Fraction of Nutrients, and Can therefore Be Used as an Effective Fertilizer once Diluted or Composted. as Sludge Production Is Low, It Can Remain in the Tank for Years Before Used.

8.14 Operational instructions for the Bio-Slurry Unit (Small Farmer with 2-3 Cows)

- I. 25-30 Kgs of Fresh Cow / Buffalo / Bull Dung and 80 – 100 Lts Water Is Needed Every Day.
- II. With 1 Part of Dung 3 - 4 Parts of Water (1:4 Ratio) to Be added and Left for Few Hours.
- III. Mix Dung and Water Well Using Hands or a Stick and Remove any Straw, Pebbles and Other Coarse Items and Filter Using an Old Table Fan Cover or Using a Green Shade Net.
- IV. Continue This Process Every Day; the Liquid Slurry Will Come Out after 20 – 25 Days of installation.
- V. The Output Slurry Can Be Directly Mixed with Canal Water for Irrigation, or to Be Filtered for injecting into Drip System – Venturi Pipe.
- VI. Yellow Container (Pressure Relief Valve) to Be Ensured with Full Water Every Day.
- VII. Crackers Burning Smell indicates the Leakage of Gas from any of the Joints.
- VIII. Weekly once Need to Jump with Bare Foot on top of the Balloon Structure to Remove any Clogged Dung / Digestate inside the Unit.
- IX. During the Rainy Season, 1-2kg of Deep Compost (Black Colour Decay) from Compost Pit to Be added to Maintain Gas Production Level Constant.

8.15 Leakage Checking Steps:

10. Take a 2 Rupees Shampoo Sachet and Mix in 500 MI Water. Using a Soft Sponge, Evenly apply and See for appearance of Bubbles at the Following Points –
 - i) Gas Draw Point at the Unit – the Hose Joint
 - ii) The Yellow Container Joint - Front and forth
 - iii) H2s Filter area, Hose Joint top & Bottom, the Coupler of the Filter Body
 - iv) Gas Stove – Hose Joint
11. Change the Iron Mesh once a Month or When It Changes Color to Dark Brown/Black (Available in any Hardware Shops)

8.16 Comparison of Bio-Slurry(B) to Farm Yard Manure(Fym)

Nutritional Value and Physical Properties of Bio-Slurry

All Studies Report a Reduced organic Matter Content of B Compared to Fym, as the Digestion Process Leads to the Breakdown of organic Biomass. the Ph-Value of B Is Usually Higher Than That of Fym That Bears the Risk of an Elevated Release of ammonia. High Concentrations of ammonia Cause Damage to Vegetation and Lead to acidification and Eutrophication of Soils. This Has adverse Effects on Ecosystems. in addition, ammonia Is an Important Precursor for the formation of Secondary aerosols. the Nutrient Composition of B Varies Widely Between Studies, always Depending on the original Substrate, the Type of Digester and the Process applied. all Studies Report a Higher Percentage of available Nitrogen in B Compared to Fym, Which accelerates the N-Uptake by Plants. This Is Particularly Visible in the Early Part of the Growth Cycle as the Higher ammonium Fraction of the B Is More Easily accessible for the Crops. the Difference Seems to Even Out Over the Length of the Growth Cycle for Most of the Crops, as the Remaining Nitrogen Mineralizes. accordingly, the C/N Ratio (Carbon: Nitrogen) of B Is Lower Than in Fym, Which accelerates the Nitrogen(N) Mineralization Process. This, in Turn, Helps the Uptake of N in the Crops, But also increases ammonia Emissions. Fym, by Contrast, Is Oxidized to Nitrates and Nitrites, Which Do Not Bond Well with Soil Particles and therefore Leach Out Faster.

I. Crop Yield

In General, It Can Be Stated That Bioslurry Has Proven to Have Positive Effects on Yields Compared to Not Using any Soil amendments and Fertilizers. in Comparison with Other organic Fertilizers Such as Fym or Compost, the Content of Readily available N for Plants Is Higher after Bioslurry application. This Is Particularly Important for Crops with a Relatively Short Cropping Cycle Such as Spring Wheat, Which Benefit from a Quick Uptake of N in their Early Growth.

ii. Crop Quality

The Protein Content of Plants (Duckweed and Cassava Leaves) Has Been Shown to Be Higher When Treated with Bioslurry Compared to Other organic Fertilisers. another Study Showed That tomato Quality in Terms of amino acid Content and Macro and Micronutrients increased Compared to Synthetic Fertiliser Treatments.

iii. Fish Production

All articles on Fish Production Showed Positive Results When Fish Ponds Were amended with B. It Can Be Concluded That an increase in Fish Production with B as Fertilizer Is Possible, without Giving any additional Protein Rich or Synthetic Fertilizer.

iv. animal Feed

There Is only Little Data on B Used for animal Feed, Which Does Not allow for General Conclusions. the only Two Scientific Studies Found on This Subject Recommended to Use B as animal Feed only in Times of Food Scarcity, or to Use It as an additive to the Normal Diet.

V. Pesticides and Herbicides

A Couple of Papers Report on the Potential of Using Bioslurry as Pesticide. Studies Found That Bioslurry Is a Good alternative to Synthetic Pesticides in order to Combat Nematode Manifestations. Other Papers Report on the Effects of Bioslurry as an alternative to Conventional Fungicides. the Researchers Found That the Biogas Effluent Does Have Fungicidal Properties, Yet in the Studies It Did Not Perform as Well as Its Synthetic Counterpart.

Vi. Soil Remediation

Despite Limited Research in This Field, Two Studies Clearly Showed That the organic Matter Fraction of B Has the Large Potential to Reduce or inhibit Substances in Soils. This Has Been Shown for the Herbicide atrazine and the insecticide Chlorpyrifos.

Vii. Pathogens

Several Studies Clearly Show That Both Temperature and Retention Time are Crucial Parameters to Determine Whether B Can Be Used without Causing Health Risks. Yet, the available Literature Does Not Give the Full Image of the Risks associated with B Use. Contrary to the Perception of Many Biogester Users, B Does in Many Cases Still Contain a Considerable amount of Pathogens, although often in Smaller Quantities Than in Undigested Manure. This Is Particularly True for the Bacteria Clostridium Perfringens, Listeria Monocytogenes, Salmonella Spp.

Literature on the Effectiveness of anaerobic Digestion on Nematodes and Viruses Is Very Scarce and Deserves Further attention among the Research Community.

Viii. Weed Seeds

Some Seeds, including Those from Undesired Weeds, Survive the anaerobic Digestion Process. Studies in This Respect are Scarce, But available Literature indicated That the Operating Temperature of the Digester and the Time of Digestion Play a Significant Role in Reducing the Germination Potential of Seeds.

Ix. Heavy Metals

There Seems to Be No indication That B Contains More Heavy Metals Than Undigested Manure. Yet, there Might Be the Risk of Heavy Metal accumulation in Biogas Sludge, Which Is also Used for Crop Fertilization.

X. Composting

When the available B Cannot Be Used at once, Storage of B Is Needed and Composting of B Can Be a Solution. after B Is Mixed with Other Biodegradable Materials and Treated Well, the Composted Fertilizer Can Be Stored for Several Weeks although the Characteristics and Nutrients Value Diminish Because of Biological Decomposition. the Composted Fertilizer Has Similar Characteristics as Manure and Can Be Used as Basal Fertilizer or as an additive to B. Since Composted B Can Be More Easily Stored and Transported Than Liquid B, It Can Be Used When actually Needed. Surplus B Can Be Sold, and thereby Generate additional income. Composted B Has the advantage of Being Considerably Cheaper Than Synthetic Fertilizer.

Application of Bioslurry:

The Bioslurry Can Be applied: (1) as a Foliar Fertiliser, Being Sprayed onto the Crops; (2) in Liquid form (Diluted) onto the Roots, or; (3) in Dry and Composted form.

Conversion of Bio-Slurry into Vermicompost

An alternative for Drying Is Composting of Bio-Slurry. to Compost the Bio-Slurry, It Has to Be Mixed with Fresh organic Material as agricultural Residues or Straw, Because the Bio-Slurry Itself Contains too Little Degradable Material to Sustain the Composting Process. During Composting, the Chemical form of the Nutrients, Especially N, Can Change and also Nitrogen Can Be Lost Through Volatilisation of Nh₃. (Ammonia)

8.17 Bio-Slurry as a Fertilizer

The Value of Bio-Slurry as a Fertilizer Depends on:

- The Nutrient Contents, E.G. the amount of Nitrogen, Phosphorus, Potassium, Calcium, Magnesium, Sulphur and Micronutrients on a Fresh or Dry Matter Basis;
- The Ratio Between Nutrients in the Bio-Slurry, E.G. the N/P-Ratio and/Or the N/K-Ratio; and
- The availability of the Nutrients, Which Is Determined by the Compounds That Contain the Nutrients.

In General, the Value of Bio-Slurry as Fertilizer Is Fairly High, Because It Contains Nutrients in a Readily available form. although on a Mass Base the Nutrient Contents are Much Lower Than in Regular Mineral Fertilizers, Which Has Consequences for Handling and the Required application Rates. the Nutrient Contents of Bio-Slurry May Fluctuate Depending on the Composition of the Manure That Is Digested and Possible N Losses During the anaerobic Digestion and Subsequent Storage and Handling. these Fluctuations in Nutrient Contents Will affect the Value as a Fertilizer. Because N Will Be Partly Present as ammonium, Which Is Directly available for Plant Uptake, and Partly as organic N, the N availability Will Be Higher Than That of Manure But Lower Than That of a Regular Mineral N Fertilizer. the ammonium/total-N Ratio Will Give an indication of the Fertilizer N Value of Bio-Slurry. the availability of P, K and the Other Nutrients Is Similar to That of Manure and Mineral Fertilizers (When Expressed Per Kg N/P/K). ammonia Volatilization after the application of Bio-Slurry to Soil Can Be High, Which May Reduce the Value of Bio-Slurry as an N Fertilizer. to Prevent N Losses by ammonia Volatilization the Bio-Slurry Should Be injected / Ploughed into the Soil, Directly after Its application.

8.18 Value added Products Based Out of Manure

The Utility of Cattle Dung Besides Producing the Massive Vermin Compost, Manure Has Now Been Much Diversified While Creating the Different Varieties of Useful Products. ahead of the Festival Seasons, Hundreds of Women, Who Run the Self-Help Group (Shgs), Have Got the orders to Supply Lakhs of Eco-Friendly Diya (Earthen Lamps) Besides Some Other Utility Products Made Out of Cow Dung to the Different Cities of the Country.

Below are Some of the Unique Cow Dung Products:

The Different Cow Dung Products include:

- Different Sizes of Colorful Diwali Diyas (Earthen Lamps).
- Idols of Ganesha & Goddess Lakshmi.
- Name Plates.
- Mobile & Candle Stand.
- Flower Pots.
- Key Chains.
- Incense Sticks.
- Herbal Gulal for the Holi Festival.

Besides Different Types of Vermicompost, Now there are Various innovative Products Being Made Through the Value addition on Cow Dung.

8.19 Waste Reduction and Recycling initiatives

Reduction Means Minimizing the amount of Waste That Is Being Created and Recycling Means Putting a Product to a New Use instead of Throwing It away. Recycling Waste Ensures the Environmental Impact and to Reduce Unnecessary General Waste.

Composting Is a Simple and Effective Way to Recycle Biodegradable Waste. It Turns organic Waste into Nutrient-Rich Soil. Recycling of Bio-Degradable Wastes Like Dung Can Be Done Through More advanced Methods, Turning into Biogas or Bio- Energy and Reducing Greenhouse Gas Emissions.

By Reducing Waste Production, We Can also Reduce the Raw Material Needed for Landfill Sites, Which Can Cause Environmental and Health Hazards. Effective Waste Management Preserves the Natural Resources and Saves Money, Promoting Environmental Sustainability.

8.20 Energy

Energy Is a Vital Requirement for Development and Is a Catalyst for a Country's Economy. '*The Lack of access to affordable and Efficient Energy Keeps a Huge Mass of People in Developing World in a Poverty Trap*'. Over 2 Billion People Lack access to Clean, Safe, and Sustainable Energy. the Lack of This access Is a Constraint to Development. Many Developing Countries Have Very Low Power Generation Capacity, Unreliable Supply, High Energy Prices and a Poor Energy infrastructure. as a Result, Poor and Marginalized People often Use Firewood and/Or Lpg for Cooking, Kerosene for Lighting, and Diesel for Electricity and Mechanical Power. these are Energy Sources with Serious Negative Impacts. Kerosene and Diesel Can Be Expensive and Unreliable, and are also Harmful to the Environment.

8.21 Energy Efficiency

Biogas Produced from Cattle Dung together with the by-Product Bio-Slurry, Can Be a Solution to Poor access to Modern Energy Services, Poverty, Climate Change, and Soil Fertility Problems. It Is a Simple and affordable Energy Supply Which Is Uncomplicated to Handle and Easy to Maintain. indeed, It Is the Cheapest Option So Far for Clean Energy Provision to Rural Households. This Makes It Ideal for Small-Holder Farmers and Families with Just a Few Cattle. Hence, there Is a Great Demand for affordable, Reliable, Renewable, and Environmentally Clean Energy. This Can Come from Wind, Solar, (Micro) Hydro Energy, and Biogas.

9. STANDARD WORKPLACE PROCEDURES FOLLOWED IN A DAIRY FARM

Dairying Is a 365 Days a Year all-Weather activity, and therefore, It Is Not Feasible for a Dairy Entrepreneur to Supervise all Operations of the Dairy Farm Round the Clock. Critical Tasks Such as Operating Milking Machines, Oestrus Detection and Many Other aspects of Dairy Farming Cannot Be Easily Measured and therefore Have Been Mechanized.

9.1. Routine activities of a Dairy Farm

Animals Prefer to Follow a Certain Routine, any Deviation in Which Can Cause Stress in the animals. Certain Operations Like Cleaning, Feeding, Milking, Etc., are Time-Consuming and Need to Be Finished in Time, therefore Proper Scheduling of Dairy Farm Operations Is Essential. Cleaning of animal Sheds and Paddock Requires Major inputs of Labour.

Various Routine activities of a Dairy Farm are Classified in Three Major Groups, I.E., Daily Routine, Monthly Routine and Quarterly or Yearly Routine.

9.2 Daily Routine Milking

1. Cleaning of Sheds Cleaning of Mangers
2. Cleaning of Milking Utensils
3. Feed Preparation Feed Distribution
4. Routine Treatments of animals
5. Oestrus Detection artificial insemination
6. Checking of Balance of Feedstock
7. Recording of Various Types of Data on a Daily Basis

9.3 Monthly Routine

1. Cleaning and Painting of Water Troughs Thorough Cleaning of Farm Premises
2. Checking of all Equipment and Machinery
3. Oiling and Greasing of Equipment and Machinery
4. Repairing of Wear and Tear inside the animal Shed

9.4 Quarterly or Yearly Routine

1. Vaccination Deworming
2. Major Repairs of Farm Building and Premises

9.5 Schedule of Daily Farm Operations

Approximate Time (Hours)	Farm Operations	Material Required
04:00–04:30	<ul style="list-style-type: none"> • Cleaning/Brushing of Milch animals 	<ul style="list-style-type: none"> • Hose Pipe. • Water Supply • Grooming Brush
04:30–06:30	<ul style="list-style-type: none"> • At the Time of Milking, animals are offered Half of the Daily Concentrate Required for Milk Production • Milking of animals 	<ul style="list-style-type: none"> • Concentrate Mixture. • Measuring Appliances • Towel • Milking Bucket • Post Milking Teat Dips
06:00–06:30	<ul style="list-style-type: none"> • Delivery of Raw Milk (In Cans) to the Milk Vendors • Washing and Disinfection of Milking Barns 	<ul style="list-style-type: none"> • Milk Storage Container • Hose Pipe • Water Supply • Disinfectants
06:30–08:00	<ul style="list-style-type: none"> • Cleaning of animal Shed and Paddock • Cleaning Farm Premises • Isolation of Sick animals • Isolation of Cows 'In-Heat' For artificial insemination 	<ul style="list-style-type: none"> • Hose Pipe • Water Supply • Broom • Rope • Rope
08:00–11:00	<ul style="list-style-type: none"> • Cleaning of Calf Pen, Calving Box, Dry Stock, and Bull Shed • Feeding of Dry/Green Fodder 	<ul style="list-style-type: none"> • Broom • Disinfectants • Dry/ Green Fodder • Feed Distribution Trolley or Tractor
	<ul style="list-style-type: none"> • Feeding Half of the Daily Concentrate Mixture to Calves, Heifers, Pregnant Cows, and Bulls • Treating Sick animals • Breeding Cows Which are 'In-Heat' 	<ul style="list-style-type: none"> • Concentrate Mixture • Feed Distribution Trolley • Isolation Shed • Medicines • Material Required for artificial insemination

	<ul style="list-style-type: none"> • Harvesting, Chaffing and Feeding of Green Fodder to all the Stock 	<ul style="list-style-type: none"> • Chaff Cutter • Feed Distribution Trolley or Tractor
16:30–17:30	<ul style="list-style-type: none"> • Delivery of Milk (In Cans) to Milk Vendors 	<ul style="list-style-type: none"> • Milk Storage Container
	<ul style="list-style-type: none"> • Washing and Disinfections of Milking Barns 	<ul style="list-style-type: none"> • Hose Pipe • Water Supply
	<ul style="list-style-type: none"> • Feeding Dry and Green Fodder to Calves, Heifers, Dry Stock and Bulls 	<ul style="list-style-type: none"> • Dry/Green Fodder • Feed Distribution Trolley or Tractor
16:00–17:30	<ul style="list-style-type: none"> • Cleaning of Milch Cattle Shed 	<ul style="list-style-type: none"> • Hose Pipe • Water Supply
	<p>Feeding Green/Dry Fodder to Milch Cattle</p> <ul style="list-style-type: none"> • Cleaning Farm Premises 	<ul style="list-style-type: none"> • Dry/Green Fodder • Feed Distribution Trolley or Tractor
	<ul style="list-style-type: none"> • Record Keeping • Accounting 	
18:30–04:00	<ul style="list-style-type: none"> • Night Watchman on Duty <p>animals are offered Half of the Daily Concentrate Required for Milk Production</p> <ul style="list-style-type: none"> • Milking of animals • Milk Testing 	<ul style="list-style-type: none"> • Measuring appliances • Towel • Milking Bucket • Post Milking Teat Dips
	<ul style="list-style-type: none"> • Cleaning Calf Pen, Calving Box, Dry Stock and Bull Sheds • Feeding Rest Other Half of Concentrate Ration to Calves, Heifers, Pregnant Cows and Bulls 	<ul style="list-style-type: none"> • Hose Pipe • Water Supply • Broom • Concentrate • Feed Distribution Trolley
	<ul style="list-style-type: none"> • Feeding of Dry/Green Fodder to Milch Stock 	<ul style="list-style-type: none"> • Dry/Green Fodder • Feed Distribution Trolley or Tractor

10. STAY UPDATED (CONNECT WITH WHATSAPP GROUPS / INFORMATION PLACES)

It Is Very Essential That the Dairy Farmers Stay Updated and are Connected Through Whatsapp Groups and are accessible to the Social Media, as It Enables them to Stay Connected with Other Farmers and with agricultural Markets, and Buyers. It Provides Real-Time Market Prices for Various Feeds and also allows them to Sell their Produce Directly to Buyers. This Eliminates the Need for intermediaries and Ensures Better Prices for them. Further, these Dairy Farmers Can:

- Watch Videos Made by Dairy Experts.
- Share Video with Other Fellow Farmers.
- Watch Videos on animal Husbandry and New Technologies available.
- As It Is a Huge Repository of interesting Videos, they Can Update their Knowledge.

10.1 Staying Updated on advancements in Dairy Farming Technology and Practices

At the Heart of Every Dairy Farm Is a Herd of Cows, and Keeping Those Cows Healthy and Productive Is Essential to the Success of the Farm. with the advent of New Technology and Data-Driven Solutions, Dairy Farmers Can Now Streamline the Way they Care for their Cows, Reduce Waste, and increase Productivity.

10.2 the Benefits of Data-Driven Farming

One of the Biggest Benefits of Using Data to Manage Your Dairy Operation Is the ability to Make More informed Decisions. by Tracking and analysing Data from Your Cows, Equipment, and Environment, You Can Gain insights into Everything from Milk Production to animal Health.

For Example, You Can Use Data to Identify Cows That are at Risk of Developing Health Issues, Such as Mastitis, Before they Become a Problem. This allows You to Take Preventative Measures, Such as Changing their Diet or Providing Extra Care, to Keep them Healthy and Productive.

Data Can also Help You Optimize Your Milking Process. by Tracking the Time It Takes to Milk Each Cow, You Can Identify Bottlenecks and inefficiencies in Your Operation. This Can Help You Streamline Your Process and Reduce the Time It Takes to Milk Your Cows, Which Can increase Productivity and Reduce Labor Costs.

Finally, Data Can Help You Reduce Waste and Improve Your Bottom Line. by Tracking Feed Consumption, for Example, You Can Identify areas Where You May Be Overfeeding Your Cows or Wasting Resources. This Can Help You Make adjustments to Your Feeding Program, Which Can Reduce Costs and increase Profitability.

10.3 Technology Solutions for Dairy Farms

There are a Variety of Technology Solutions available to Help You Manage Your Dairy Farm More Efficiently. Some of the Most Popular Solutions include:

- Automated Milking Systems: these Systems Use Robotics to Milk Cows without the Need for Human intervention. This Can Help Reduce Labor Costs and Improve Milking Efficiency.
- Electronic Identification: This Technology Uses Rfid Tags to Track Each Cow's Movements and Behavior. This Can Help You Identify Cows That May Be at Risk of Developing Health Issues and Provide them with Extra Care.
- Environmental Sensors: these Sensors Can Track Temperature, Humidity, and Other Environmental Factors That Can Impact Cow Health and Productivity. This Can Help You Make adjustments to Your Barn Environment to Keep Your Cows Comfortable and Healthy.
- Data analytics Platforms: these Platforms allow You to Collect and analyze Data from a Variety of Sources, including Milking Systems, Environmental Sensors, and Cow Behavior. This Can Help You Make More informed Decisions about Your Operation and Improve Efficiency.

10.4 Getting Started with Data-Driven Farming

If You're interested in Using Data and Technology to Improve Your Dairy Farm, there are a Few Steps You Can Take to Get Started:

Identify Your Goals: What Do You Hope to achieve by Using Data and Technology on Your Farm? Do You Want to Reduce Labor Costs, Improve Milk Production, or Something Else? once You Know Your Goals, You Can Start to Identify the Solutions That Will Help You achieve them.

Choose Your Technology Solutions: there are a Variety of Technology Solutions available for Dairy Farmers, So It's Important to Choose the ones That are Right for Your Operation. Consider Factors Such as Cost, Ease of Use, and Compatibility with Your Existing Equipment.

Collect and analyze Data: once You Have Your Technology Solutions in Place, You Can Start Collecting Data from Your Cows, Equipment, and Environment. Use a Data analytics Platform to organize and analyze This Data, and Use the insights You Gain to Make informed Decisions about Your Operation.

Take action: Finally, Use the insights You Gain from Your Data to Make Changes to Your Operation. This Might involve adjusting Your Feeding Program, Providing their Cows with Wearable Sensors and Tracking Systems That Monitor Everything from activity Levels and Location to Feed intake and Milk Production. This Data Is then analyzed to Provide insights on Each Cow's Health and Well-Being, Which Helps Farmers Make informed Decisions about their Care.

By Using Data analytics, Farmers Can Identify Cows That May Be at Risk of Illness or injury and Take Preventative Measures to Ensure their Health. This Not only Improves the Welfare of the Cows But also Reduces the Risk of Loss for the Farmer.

10.5 automated Milking Systems

Another Way That Technology Is Improving Dairy Farming Is Through the Use of automated Milking Systems. these Systems Use Sensors to Identify When a Cow Is Ready to Be Milked and then automatically attach Milking Machines to the Cow. This Not only Reduces Labor Costs But also Improves Milking Times, as Cows Can Be Milked More Frequently without Putting additional Strain on the Farmer.

Additionally, automated Milking Systems Can Provide Data on Milk Production and Quality, allowing Farmers to Identify Trends and Make adjustments to Improve Overall Efficiency.

These innovative Machines Have Not only Enhanced Efficiency, But Have Liberated Farmers from the Labour-Intensive Task of Manual Milking, Providing Numerous advantages. This automation Optimizes Milking Schedules, and Ensures Consistency and Precision. Each Cow's Milk Yield Is Recorded and Monitored, allowing Farmers to Identify any anomalies Promptly.

10.6 Precision Feeding

Precision Feeding Is another Technology That Is Being Utilized in the agriculture industry to Improve animal Health and Productivity. Precision Feeding Systems Have Emerged as a Game-Changer for Dairy Farms. these Systems Employ Technology to Dispense Precise amounts of Feed and Help Ensure That Each Cow Receives the Optimal Balance of Nutrients. by analyzing Data on Each Cow's Feed intake and Nutritional Needs, Farmers Can Provide Customized Diets That Ensure Each Cow Is Receiving the Optimal amount of Nutrients for their Specific Needs.

This Not only Improves Cow Health and Well-Being But also Reduces Feed Waste and Costs. in addition, Precision Feeding Can Help to increase Milk Production and Quality, Resulting in Higher Profits for the Farmer.

Traditional Feeding Methods often Result in Overfeeding or Underfeeding, Leading to inefficiencies and increased Costs. with Technology-Driven Precision Feeding, Feed Is Dispensed accurately, Minimizing Waste, and Saving Money.

10.7 Environmental Monitoring

Sustainability Is a Growing Concern and Technology Is Playing a Pivotal Role in Helping Farms Reduce their Environmental Footprint. Environmental Monitoring Systems Track and Manage Various Factors, including Water Usage, Waste Management, and Energy Efficiency. by Closely Monitoring Resource Consumption, Dairy Farms Can Identify areas Where they Can Operate More Sustainably and Reduce their Ecological Impact, Contributing to a More Sustainable and Responsible industry.

Action to Be Taken

As a Dairy Farmer, there are a Few Key Steps You Can Take to Start Implementing Data and Technology into Your Operations:

- Research and invest in Wearable Sensors and Tracking Systems for Your Cows.
- Explore the Use of automated Milking Systems to Improve Efficiency and Reduce Labor Costs.
- Implement Precision Feeding to Ensure Each Cow Is Receiving the Optimal amount of Nutrients for their Needs.
- Work with Experts in Data analytics to analyze the Data Collected and Make informed Decisions about Your Operations.
- By Embracing Technology and Data analytics, Dairy Farmers and Livestock Producers Can Improve their Operations, increase Profitability, and Ensure the Health and Well-Being of their Cows.

10.8 Collaboration with agricultural Research institutions

In Indian Context, Dairy Is an Important Part of agriculture Sector, and Milk Is an Essential Item That Facilitates income Generation to Small and Rural Households and a Source Item for Several Other Businesses and activities.

The Results of This Research Suggested the Policy Planners and Government to Ensure Subsidized and insured Technologies, Training Support and Facilities, Educational Opportunities, and Efforts for Promotion of Technology adoption among Dairy Farmers.

List of agricultural Universities and Research institutions

- Agricultural/Veterinary Universities of Various States
- Krishi Vigyan Kendras.
- State Department of animal Husbandry
- State institute of Rural Development
- National Dairy Research institute (Ndri) Karnal (Haryana)

11. RISK MANAGEMENT AND SUCCESSION PLAN

11.1 Identifying and Mitigating Potential Risks in Dairy Farming

We Can Identify and Rectify the Problems Occurring in a Dairy Farm by Ensuring That all Stringent Measures are Taken into account Which Can Be Done by Regular inspections with Proper Record Keeping. Regular Visits by a Veterinary Doctor Should also Be Mandatory.

11.2 Risk Management

- Risk Is Basically Uncertainty about the Future, Hence the Difficulties Farmers Have to Live with When Trying to Predict their Farm Performance and Profitability in Years to Come.
- There Is Business Risk and there Is Financial Risk. Business Risk Is the Cost of inputs, Returns from Outputs and the Level of Farm Production, While Financial Risk Is Concerned with the Uncertainty about Using Other People's Money.
- Sources of Risk Can Be External and internal. External Sources arise from Natural, Economic, Social and Political Environments, While internal Sources are Those to Do with the Farm Manager, Such as His Health, attitudes and aspirations.
- There Is Short-Term and Long-Term Risk. Variations in Milk Prices are a Good Example of Long-Term Risk Currently influencing the Smallholder Dairy Farmer.
- Farmers Can Develop Risk Management Strategies, Such as Planting More Drought-tolerant forage Legumes as Well as Higher Yielding forage Grasses.
- Farm Budgets and Sensitivity analyses are Useful tools for Managing Risk.
- Biosecurity against introducing Cattle Diseases and Other animal Health Problems Is a Good Example of Risk

A Dairy Business Is Made Up of a Mix of People, Livestock, Natural Resources, Technology, Economics and Finance. Farmers Buy their inputs to Production and Sell their Milk in the Markets. What they Do Is Subject to Laws and affected by Things Governments Do. Running a Farm Business Means Dealing with Lots of Risks. there Is Risk about How Much Grass they Can Grow, How Much Milk their Cows Will Produce and of What Quality, Hence Unit Price. there Is Risk about What their Farm Production Will Cost and How Much It Is Worth. there Is Risk affecting How Much Spare Cash they Will Have to Pay interest to the People Who Have Loaned Funds to their Farm Business. there Is Risk about What Governments all Over the World Might Do That Will affect How the Farmer's Business Is able to Operate.

Most Farm Decisions involve Risk or Uncertainty. Risk and Uncertainty Challenge the Technical and Managerial abilities of all Farmers. they Impact on Every Part of Farming: Its Productivity, Stability, Resilience and Equity. Uncertainty Is Defined as Imperfect Knowledge, or Not Knowing What Is Going to Happen in the Future. Decisions That Do Not Have a Single Outcome are then Uncertain Decisions. Risk Is only Present When the Uncertain Outcomes of a Decision are Regarded as Significant or Worth Worrying about.

Rather Than the Risk, It Is the Consequences of the Risk That Matter Because they Have to Be Managed to achieve Resilience in the Farm Business. Resilience Is the ability of the System to

withstand Severe, Usually Unpredictable, Disturbing Factors and includes Consideration of the Rate and Degree of Recovery from That Disturbance. Resilience then Depends on How Well the Risks are Understood and incorporated into Farm Decisions, the ability of the Farm Business to Respond to Unforeseen Events and the Capacity of the Farmer to Cope in the Face of adverse Outcomes. Uncertainty Means That the Financial Performance of the Farm Business Cannot Be Controlled and accepting This Makes a Good Manager. the Key Objective of Farming Is Long-Term Survival, and Farmers Should Focus on Defining and Working towards the Farm's Productive Potential. This Will Position the Farm to More Fully Exploit Business Opportunities as they arise.

11.3 Business Vs Financial Risk

There are Two Main Types of Risk in Farming, Business Risk and Financial Risk.

Business Risk Stems from Variable Yields of Crops, Reproduction Rates, Disease Outbreak, Climatic Variability, Unexpected Changes in Markets and Prices, Changes in Government Policies and Laws, Fluctuations in inflation and interest Rates and Personal Mishaps. Sources of Business Risk Can Be Condensed to Price and Production. these Exist Regardless of Financial Matters, Such as How Much Money Is Borrowed. Price Risk Refers to Change in Prices of inputs and Outputs, Whereas Production Risk Results from Factors Such as Weather and Pests That affect Output Yields. these Risks affect the ability of the Business to Pay for the inputs Used, to Service any Debt and to appropriately Reward Labour and Management.

Financial Risk Derives from Other People's Money That Is Used in the Business Relative to the Proportion of the Owner-Operator's Capital. the Higher the Ratio of Debt to Equity, the Higher the Financial Risk. any New Farm Practice Must Be assessed Both as a Business and Financial Risk. It Could Look Good from a Technical Viewpoint or after Considering the Market forces Beyond the Farm, But It Must Be Financially Feasible Before It Should Be adopted. If It Requires Borrowing Large amounts of Capital and Reducing Equity to Dangerously Low Levels, This Could Make It Vulnerable in adverse Circumstances. therefore, It Becomes too High a Financial Risk and Should Be Rejected at This Particular Time.

11.4 External Vs internal Sources of Risk

Another Way of Looking at Risk Is Whether It originates from Sources External to the Farm or the internal ones affecting the Farm's Operating Efficiency. External Sources of Risk arise from the Natural, Economic, Social and Political Environments. of Most Importance Is the Natural or Climatic Environment (That Is, Nature). Farming Is Profoundly affected by Nature, Which Provides all the Basic Elements for Biological Growth and Production, Such as Short-Term and Long-Term Weather, as Well as the Many Natural Hazards Such as the Recent Earthquakes, Tsunamis, Volcanic Eruptions and Landslides Seen in indonesia Over the Last Few Years. all these affect Yields and Market Supply, Hence Global and Local Prices.

Risks of the Economic Environment Relate to the Market (Demand and Supply), Hence Prices of Farm inputs and Outputs, inflation and interest Rates and Productivity Through the availability and Merit of New Technology. the Social Environment Is Not a Major Source of Risk, although Over Time, It Can influence Education and Lifestyle, Hence Impacts on Farm Labour Supply. Social Upheavals Such as Civil Conflicts are Certainly Becoming More Important in Developing Countries.

Political Factors influencing Risk include Change in Government Policies Which Can influence Commodity Prices and Marketing, availability and Cost of Credit, Public infrastructure, Environmental Standards, Labour and Import Laws, Exchange Rates and Many Other Government Reactions to the Globalisation of Our Food Production. Other More Typical Political influences are Changes in Political Ideology, Such as Moving from a Socialistic Centrally Planned, to a Capitalistic Free Market Economy.

Sources of internal Risk affect the Operation of Each individual Farm and include the Health of the Farm Household, their interpersonal Relations as influenced by Personality, Changing Values, attitudes and aspirations. they also include the Farmer's approach to Conservation of Farm Resources, Use of Credit to Finance Farm Development and intergenerational Transfer of Farm Ownership. there Is an additional one involving any External Farm advice, Namely Its Relevance to, and Its Likely Impact on, That Particular Farm. Such a Change in Farm Practice Could Impose additional Pressures on the Social, Biological or Economic aspects of the Current Farming System. This Can Be Particularly Important for Near Subsistence Dairy Farmers with Little Contact with their Potential Markets. Milk Can Be Sold Through formal or informal Markets, While in More Subsistence Operations, the Milk May Be Consumed on-Farm or Bartered for Other Goods. increasing the Farm's Output of Raw Milk May Lead to a Change in Market Outlets, and a New Set of Risks for the Farmer.

11.5 Risk in Short-Term and Long-Term Decisions

Changes in Product Prices and Yields are the Most Important Short-Term Risks, Because the Cost of the Key Variable inputs (Such as Purchased Concentrates and Fertilisers) are Either Known and/Or Determined by the Farmer at the Time of the Decision.

In the Long Term, all Yield Price and Cost Variables are Uncertain, Even Those Under Government 'Control'. Yields Can Be Predicted with Some Degree of Confidence without the Occurrence of Unpredictable Climatic Events. the increasing Costs of Importing Cereal Grains Is one Classic Uncertainty adversely affecting asian Smallholder Dairy Farmers in Recent Years. the Extreme Volatility of Cost of Imported Dairy Products Is another Long-Term Uncertainty, as This affects Farm Gate Milk Prices. all these Uncertainties Make Farmers Very Cautious with their Decision Making Because their Survival Depends More on Surviving adverse Outcomes Than Benefiting from Good Outcomes.

On the Whole, Farmers, Particularly Resource-Poor Smallholders, Exhibit Risk aversion Rather Than Risk Neutrality or Risk Preference. Small Farmers are More Susceptible to Downside Risk Than are Other Sectors of Society. they are More Exposed to the Vagaries of Nature and Don't Have Easy access to insurance or Futures Markets Because of their Small-Scale Structure. Unlike Larger Operations, they Don't Normally Use the More formal Market Based institutional approaches to Risk Management Such as Bank Lines of Credit or Overdrafts, Crop and Livestock insurance, forward Pricing Through Price, Futures or Options Contracts or Market Guarantees Through Vertical integration.

11.6 Good and Bad Risks

People Outside Farming Generally View Risk as Something to Be Minimised. Farmers Clearly Know That Minimising Risk Can Minimise Farm Returns as Well. Risk Is then the Source of above average Profits and Losses. Risk and Uncertainties Create Opportunities and Rewards

That People are in Business to Capture. If the Future Was Known with Certainty, the Profits Would Have already Been Made.

Fundamental to Understanding Risk in Farming Is to Distinguish Between Good and Bad Risks, and Right and Wrong Decisions.

A Good Decision Is Based on the Best information and Judgement available at the Time. Whether It Turns Out to Be Right or Wrong Depends on the Outcome of Subsequent Events. for Example, the Decision to increase Herd Size Should Be Based on an Expected increase in Demand for Feed Nutrients and their Supply from Home-Grown forage Supplemented with Purchased Feeds (Additional forage and Concentrates) When Required. Such a Decision Can Be Classified as a Good one If It Is Made Using Sound information on Historically Typical forage Growth Rates and Purchased Feed Costs. However, increasing Herd Size Could Turn Out to Be the Wrong Decision If Seasons and Costs Vary Substantially from the Expected.

Bad Decisions are Those Made without Considering the Best information available and these often Have Little Prospect of Success If the Expected Conditions Prevail. only Good Luck Can Make a Bad Decision the Right Decision. in Far too Many Situations, Smallholder Dairy Farmers May Decide to increase Herd Size or Purchase High Genetic Stock without Considering their increased Feed Requirements. they invariably Find That although the Farm May Produce More Milk, the Per Cow Milk Production actually Decreases and with It, the Efficiency of Converting Home-Grown and Purchased Feed into Milk. Granted, the Farm Has More Stock, Hence More assets, although the Equity May Not Change If Money Had to Be Borrowed to Purchase them. However, If Each Cow Produces Less Milk Because of Less Feed Being available, the Decision to increase Herd Size or Purchase Superior Stock, Will adversely affect the Overall Business Performance of the Farm. Not only Was It a Bad Decision, But the Farm Now Has an increased Risk to Higher Unit Price Changes for Feed Supplies (Both on-Farm and Purchased).

One Major Problem to Decision Making in Tropical Dairy Farming Is the Lack of Objective Data available with Which to Make Such Major Farm Decisions. without a Good Knowledge of Yields and Quality of Home-Grown forages, It Is Difficult to Make Good Decisions on Optimum Stocking Capacities on Smallholder Farms. the Bottom Line Is That to Provide Sufficient Quality Home-Grown forage for a Well-Balanced Diet to all Stock, the Typical 0.5 Hectare Smallholder Farm Should Have No More Than Two to Five Milking Cow Units, That Is Two to Five adult Cows Plus one Replacement Heifer, Depending on Management of the forage Production area. therefore, a Good ‘Rule of Thumb’ Is – for a Farm Depending Entirely on Home-Grown forage and with a Typical Level of forage agronomy – No More Than Eight Cows (Together with their Replacements) Should Be Kept Per Ha of forage Production area.

11.7 Crisis Management Strategies

Crisis Management Is the application of Specific Strategies by an organization in Response to a Sudden and Significant Negative Unforeseeable Event. This Unforeseeable Event That Has Created Risk for an organization Could Range from an internal to industry or Even Societal Level.

There are a Variety of Risk Management Strategies That Smallholder Dairy Farmers Can Use. in Drought-Prone areas, Diversification of Cropping Systems Is a Risk Management tool. Use of Different Varieties and Sowing them in Different Sequences (Rotations and Location within

the Farm) Can Improve Yield and income Stability Because Crop Mixtures Generally Yield Better Than Monocultures Under Stress Conditions. in addition, they Can Reduce the incidence and Build-Up of Pests and Diseases and Even Exhibit Compensatory Yields. Differences in Terms of Days to Maturity and Variability in Resistance or tolerance to Stress also Reduce the Chance of total Crop Failure. This applies to Both Cash Crops, Which often Supply by-Products for Livestock Enterprises, as Well as forage Crops Grown Specifically as Livestock Fodder. Planting More Drought-Tolerant forage Legumes as Well as Higher Yielding forage Grasses Is a Good Example of Risk Management.

11.8 analysing Risk in Farm Management

Farm Management Can Be Defined as a Process by Which Resources and Situations are Manipulated by the Farm Manager in Trying, with Less Than Full information, to achieve His Goals. When a Change Is Made on a Farm, the Final Outcome Will Not Be Precisely That Which Is Thought Most Likely to Happen at the Time the Change Was Made. Many Different Outcomes are Possible. Farmers Make Decisions Based on their Best Guesses about the Responses of Outputs to inputs and the Variability of these Responses. the Resilience of Farm Systems Is Most Severely Tested by the Relatively Rare But Most Severe Circumstances That May Occur When Drought (Hence Low Yield), for Example, Coincides with High Feed Costs, Low Milk Prices and High interest Rates. or, in an Extended Run of Dry Conditions, Poor Prices and High interest Rates. Conversely, the Risk of Encountering a Combination of Favourable Events with Resulting High incomes, Needs to Be Prepared for. Weather and Economic Conditions May Be More Stable in the Humid Tropics Than Elsewhere. Suppose the Question Is Whether in a Particular Situation, one System of Dairying Has More Potential for Profit Than a Feasible alternative. for Example, the Decision Comes Down Either to Maintaining a Farm Stocking Capacity of Eight Milking Cows Per Ha forage Production or increasing It to 12 Cows Per Hectare and Relying More on Purchased forages.

One approach Would Be to Undertake a Risk analysis to:

- Test the Effects on Milk Production of Different Levels of Stocking Capacities Either Singly or in Combination, Say 8 Versus 10 Versus 12 Cows Per Hectare.
- Test the Performance of the Various Systems Under the Full Range of Possibilities for Feed Costs (Home-Grown and Purchased), Herd Costs, Farm Milk Yields and Reproductive Performance and for Various Milk Prices.

Once the Raw Data are available for Undertaking Such a Series of analyses, Whole-Farm Budgets Could Be Developed. the Result Is That instead of a Single Value of Operating Profit for Different Farm Stocking Capacities, Probability Distributions of Operating Profits, Net Present Values, internal Rates of Return and Net Cash Flows for the Various Systems Can Be Generated.

The Key to Managing Risk Is, information. This information Must Be about Technical, Human, Financial, and Beyond-Farm Elements of the System. the Resilience (Survival) of Farm Systems Is Ultimately Determined by Circumstances Experienced. in addition, the Quality of Such Management Decisions Depends Critically on the Quality of information available and the Quality of Processing That information. This involves Judgement and intuition, Which Is Knowledge Gained from Experience and Past Learning and Understanding the Whole System. Part of Decision analysis and Decision Making Is Testing intuition, Using analytical tools Such as Whole-Farm Budgets and Risk analysis. It Is Not Necessary to Know Everything about

Everything to Decide – Just Enough about Enough. the Best approach Is to attain Maximum information from Minimum Data.

Being Rational, Farmers Typically Make their Risky Decisions in a Reasoned Way, on the Basis of their Experiences, Traditional Knowledge and Whatever Other information Is available to them. Firstly, they Would assess the alternative Choices, Develop a Set of Uncertain Outcomes associated with Each alternative then Finally Use their Personal Subjectivity to Choose their Line of action. for Smallholder Farmers, Such a Decision Is Usually Carried Out in an informal (Implicit) Rather Than formal (Explicit) Manner. Larger Operations, Utilising the Services of Professional Farm advisers, Would Be More Likely to Use a More formal approach to Major Farm Decisions.

one Such approach Is the Sensitivity analysis, Which Could Be Easily applied to any Farming Situation. a Sensitivity analysis assesses How Sensitive a Decision's Outcome Is to Changes in the Major Variables affecting That Decision. It Is Quantified by Testing the Effects of Variations in Selected Cost and Benefit Variables on Budgeted Outcomes of the Decision. these Variations are Calculated for a Percentage Change above and Below the Values Used in the Base Budget.

11.9 Biosecurity as a Risk Management Strategy

Ideally Every Dairy Farm Should Be Separated from the Outside World, But as This Is Not Practical, a Risk-Based approach Should Be Developed. Such an approach Requires the Farmer to:

- Identify the Pathogens and their Potential Impact.
- Identify the Likelihood of these Pathogens Establishing on the Farm.
- Decide on Whether the Disease Risk Is Worth Controlling or Not.
- The Most Significant Risks for introducing Diseases Come from Many Sources, Such as:
- Animals and insects: Sick or Dead Cattle, introduced Stock, Neighbouring Stock, Wild S Birds and animals (Including Rodents), Pets, Flies and Other insects.
- People: Family and Friends, Visitors, Farm Staff, Livestock agents (Including S Veterinarians), Tradesmen.
- Inorganic Material: Borrowed Farm Equipment, Market Equipment (Trailers), Vehicles (Motorbikes, Utility Trucks, Stock Transport).
- Organic Material: Surface Water, Farm Manure, introduced Feed, Potentially S Contaminated Feed (Opened Bags of Feed).

Animal Disease Comes in Many forms So Requires Different approaches Depending on Its Type. these are Six Categories of Disease Sources:

- Viruses, Such as Foot-And-Mouth Disease, Rotavirus, infectious Bovine Rhinotracheitis, Enzootic Bovine Leucosis, Pestivirus, Warts
- Bacteria, Such as E.Coli, Clostridia, Salmonella, anthrax, Leptospirosis, Brucellosis, Tuberculosis, Johne's Disease, Pink Eye, Vibriosis, Haemorrhagic Septicaemia, Mastitis
- Protozoa, Such as Cryptosporidea, Coccidiosis, Neospira
- Parasites, Ticks, Lice, internal Parasites, Tick Fever

- Fungi, Such as Ringworm
- Others, Such as Genetic Defects, Drug Resistance, Bovine Spongiform Encephalopathy (Or Mad Cow Disease).

The Risk Management Strategy Can Vary Depending on the Potential Level of Risk:

- Accept the Risk If It Is too Small to Worry about or too Expensive to Control.
- Avoid the Risk by Removing It altogether, Such as Not Purchasing the Item or Changing Farm Suppliers. Transfer the Risk, Such as Contracting Someone to Rear the Calves.
- Mitigate the Risk by Taking actions to Lessen the Probability of It Occurring.
- There are Various Ways to Manage the Risk Such as:
- Building Barriers against the Pathogen, Both Physical and Procedural.
- Increasing Resistance in the Dairy Herd, Through Vaccinations and Good Management.
- Early Detection by Routine Disease Monitoring and increased Surveillance.

General Management Practices include:

- Selecting Reputable Farm Suppliers with Good Hygiene.
- Reducing Build-Up of Pathogens.
- Limiting Vehicle and People
- Establishing Quarantine areas for introduced Stock.
- Segregating Stock Classes.
- Developing Standard Operation Procedures and Checklists for Routine Farm Tasks.
- Ensuring Good Farm Hygiene and Cleanliness.
- Developing an Emergency Plan in Case of Disease Outbreak.

11.10 Safety /Security /Insurance Coverage

Ensuring Farm Safety: Regulations and Best Practices for Farmers

People Working on Farms are at a High Risk of accidents. However, Farm-Related accidents Generally Tend to Be Preventable If Proper Safety Procedures are Used by the Farmer at all Times.

Farm Safety Measures

- i. Following Regular Maintenance and Repairs, Replace all Guards and Shields That are Showing Signs of Wear and Tear.
- ii. Always Thoroughly Read the Manual for Each Piece of Electronic or Handheld Equipment. Technology Is always Evolving. therefore, It Is Important That You Not only Keep in touch with them But also Know the Proper Way to Handle them.
- iii. If You are Not Comfortable with Repairing and Maintenance of Farming Equipment, then Seek Professional Help for Routine Services and Repairs.

- iv. While Working in Extremely Hot Conditions During Peak Summers Try to Wear Lightweight and Loose-Fitting Clothing. ask Your Laborers to Do the Same as Well. Cover Heads with a Head Wrap or Cap and Designate a Shady Spot to Cool off. Take and Give Frequent Breaks. always Make Drinking Water Readily available. also, Develop a Heat Stress Prevention Plan in Case of Heat Stroke.
- v. Make Sure That the Workers Hired for Seasonal Work Know How to Use the Farming Equipment and are Trained in the Ways of Properly Using the Said Equipment.
- vi. Take Short Rests Throughout the Day and afford the Same Privilege to Contract Workers as Well.
- vii. Operating the Same Machinery for Extended Periods of Time While Feeling Fatigued Can Cause You to Lose Control of the Vehicle. therefore, Rest Whenever You Feel Overwhelmed.
- viii. Consuming alcohol to Be Completely Prohibited During Work Hours at the Farm. the Combination of alcohol and Farm Equipment Can Be Dangerous as It Can Cause Massive Damage to the Quality and Quantity of the Yield.
- ix. If You Have Children or allow Your Workers to Bring their Children on the Farm, then It Is advised to Build a Separate Play area for the Children, Which Is Far away from Machinery. Children Tend to Be Curious, therefore, appoint a Guardian for them as Farming accidents Can Be Fatal for Children.
- x. While applying Fertilizers and Pesticides, It Is Extremely Important to Wear and Provide Others with Respiratory Protection as they Contain Chemicals That are Not Safe to Be inhaled. the Farm Worker Must also Wear Respiratory Protection While Working in Confined animal Facilities, Cleaning Up Bird or Rodent Droppings, Cleaning Biological Contaminants, Handling Moldy Grain, and Cleaning Grain Bins.
- xi. Respirator Protection Helps to Filter Out Harmful Chemicals or Biological Contaminants That Can Otherwise Have Detrimental Effects on Our Health. Respirators Can Be Purchased from agricultural Safety Supply Stores, and Chemical Suppliers, and are also available online.
- xii. Dairy Farmers Should Closely Monitor their Herds to Ensure Each animal's Health and Well-Being. an Important Part of This Effort Is Following industry-Recommended Measures for Security (Physical Protection of People, animals, Equipment, and Property) and Biosecurity (Protection of People and animals against the introduction and Spread of Disease and toxins).

11.11 insurance of the Livestock

General Terms:

1. Premium Rate: 4.00% Per annum Subject to Minimum of Rs 1000. applicable Gst Will Be Charged additional.
2. Only Milch Cattle, Buffaloes, Heifers, and Breeding Bulls Should Be Covered.
3. Animals Below the age Limit of 4 Months and above 10 Years (If any) Would Be Out of Scope of Cover.
4. Coverage Would Be for Death Per the Cattle & Livestock Policy of Iffco-Tokio Gic
5. Identification of the insured animals Should Be Through Company's Rfid Tags and Muzzle Reading
6. Maximum Sum insured Per animal Would Be the Present Market Value of the animal (Capped at Rs.50,000 Per animal).
7. The Market Value and Health Condition of the animals Should Be Certified by a Qualified

Veterinarian.

8. Tagging Photographs Would Mandatory. there Should Be at Least Three Photographs Per animal Taken at the Time of Tagging. one Photo Should Show Us the Front View of the animal with Rfid Reading and the Second and Third one Should Show Complete Body of the animal from Both Sides (Left & Right).
9. Policy Term: 1 Year
10. Claims Process, Other Terms and Conditions Would Be applicable as Per Standard Cattle & Livestock Policy of the Company. Please Refer to the attachment for Detailed Policy Wordings.
11. Commission Payable to the intermediary Would Be as Per the Standard Irdai Prescribed Rates.

Enrolment Process:

1. Insured to Finalize the Date of Tagging and Location.
2. Tagging Should Be Planned in a Group. the Same Should Be Communicated to Iffco-Tokio Local office/Designated Member of Iffco-Tokio at Least Two Working Days in advance for Logistics arrangement.
3. Iffco-Tokio Local office Coordinates with Your Veterinary Doctor for Tagging. However, Tagging Should Happen in Presence of Designated Staff of Iffco-Tokio.
4. Veterinary Doctor to Examine Health Status, Market Value and insurability of the Cattle. If Satisfied, applies Tag, Issue Health Certificate and Iffco-Tokio Staff Will Take Photographs as Required.
5. Cost of Tagging (Doctor Fees for Tagging & Health Certificate) Will Be Borne by the insured
6. Veterinary Doctor to Submit the Details to insured and insured then in Turn Submit the Same to Iffco-Tokio with Premium Cheque.
7. Iffco-Tokio Local office: to Cross Verify the Details and Premium Received with the original approval.

Retagging:

In Case of Fall/Loss of Ear Tag, animal Will Be Retagged Immediately and the Same Should Be intimated to Iffco-Tokio within 24 Hours for Necessary Endorsements with Photographs of the Retagged animal and a Fresh Veterinary Health Certificate. Here also, Photography Should Be with Gps Enabled Cameras. It Must Be Ensured That Retagged animal and originally Tagged animals are one and the Same. No animal Should Be Retagged If It Is Sick.

11.12 Cattle & Livestock insurance Policy

The Company Hereby agrees Subject to the Terms, Provisions, Conditions, Contained Herein or Endorsed to Otherwise Expressed thereon That If any animal Described in the Schedule and Belonging to the insured Shall Die from any Disease or accident (Including Fire and Lightning) Contracted or Occurring During the Period of insurance Stated Herein or any Subsequent Period in Respect of Which the insured Shall Have Paid and the Company Shall Have accepted the Premium Required for the Renewal or Extension thereof the Company Will Pay to the insured after Receipt of Proof of Death Satisfactory to the Company the Loss Which the insured Shall Suffer by the Death of Such animal Not Exceeding the Sum insured in Respect thereof as Stated in the Schedule Hereto Exceptions

Provided always That This Policy Does Not Cover (Unless Expressly agreed to by the Company in Writing) Death Directly or indirectly Due to arising Out or Resulting from

1. Malicious or Wilful injury or Neglect, Over Loading Unskillful Treatment or Use of animal for Purpose Other Than Stated in the Policy without the Consent of the Company in Writing.
2. Diseases Contracted Prior to Commencement of Risk. and Provided always That any Claim arising Out of Disease or Illness Contracted by the animal During the First 15 Days from the Commencement Date of Policy. This Exclusion Shall Not However, apply If insurance Is in Existence for a Continuous Period of 12 Months without any Break and animals Under "Scheme
3. Intentional Slaughter of the animal Except in Cases Where Destruction Is Necessary to Terminate incurable Suffering on Humane Consideration on the Basis of Certificate Issued by Qualified Veterinary Surgeon or in Cases Where Destruction Is Resorted to by order of Lawfully Constituted authority.
4. Theft or Clandestine Sale of the insured animal
5. Permanent total Disability, Which in Case of Milch Cattle Results in Permanent and total incapacity to Conceive or Yield Milk, Which in Case of Stud Bulls Result in Permanent and total incapacity for Breeding Purpose and in Case of Bullocks and Castrated Male Buffaloes Result in Permanent and total incapacity for the Purpose of Use Mentioned in the Proposal.
6. This Exclusion Can Be Deleted on Payment of the Required additional Premium in Which Case insurer's Liability Is Restricted to 50 to 70% of Sum insured or Market Value at the Time of Loss Whichever Is Less..
7. War, invasion, act of foreign Enemy, Hostilities (Whether War Be Declared or Not) Civil War, Rebellion, Revolution, insurrection, Mutiny, Tumult, Military or Usurped Power or any Consequence thereof or attempt there at.
8. The indemnity or Compensation Provided by This Policy Shall Not apply to Nor include any accident, Loss, Destruction, Damage or Legal Liability Directly or indirectly Caused by or Contributed to by or arising from Nuclear Weapons Materials.
9. Consequential Loss or Legal Liability any Kind or Description.

Conditions

1. If there Shall Be any incorrect or Untrue Statement in the Proposal Herein Referred to, or If the insured Shall Not State any Material Fact or, Circumstance at the Time of Proposal or afterwards or, at the Commencement of the Risk Hereunder or on any alteration or Extension or Renewal of This Policy, or If He Shall Make any False or Fraudulent Claim, or Shall Fail in Particular to Observe and Perform the Terms and Conditions Hereof, This Policy Shall Be Void and all Premiums Paid Hereon Shall Be forfeited to the Company.
2. Every animal Must Be Sound and in Perfect Health and Free from any injury at the Time of the Proposal for insurance or for any Renewal, addition or Substitution and Must also Remain Sound and Be in Perfect Health and Free from any injury at the Time of Payment of the Premium or Balance thereof.
3. The insured Shall Permit any authorized Representatives of the Company at all Times to inspect the animals Hereto insured and the Premises of the insured Where the animals are Stabled and the insured Shall Furnish any information Which the Company May Require and Shall Comply with all Reasonable Regulations and Direction from Time to Time Given by the Company.

4. The insured Shall Give Immediate Notice in Writing to the Company of any Illness or Lameness or accident or injury to animal Hereby insured.
5. The insured Shall Ensure Every animal insured to Have Sufficient and Proper Food, Water and Shelter and Shall Keep Secure all Fences, Wards Sheds and Stabling and Shall at all Times and to the Best of His Knowledge and ability Use and Exercise Every Due and Proper Precaution and Safe Guard against Loss or Danger or Loss Under This Policy; the intent and Meaning of This Condition Being That Each insured animal Shall Have Same Care and attention as When Not insured.
6. No Claim in Respect of Death of animals Covered Under the Policy Shall Be Entertained Unless the Ear Tag/S in Respect of animal/S and Is/ are Surrendered to the Company. in the Event of Loss of Ear Tag/S It Is the Responsibility of the insured to Give Immediate Tag Loss intimation to the Concerned insurance Company and Get the animal/S Re-Tagged and Submit Re-Tagging Certificate to the insurance Company Subject Otherwise to the Terms and Conditions of the Policy.
7. In the Event of Illness or accident the insured Shall, at His Own Expense Immediately Obtain the Service of a Qualified Veterinary Surgeon and Ensure the animals to Be Properly Treated. on the Death of any animal Hereby insured, the insured Shall, Give Immediate Notice thereof to the Company (At the office Which Has Issued the Policy; and Shall Give the Company an Opportunity of inspecting Carcass Until at Least the Expiration of Twenty- Four Hours after Such Notice Shall Have Been Received by the Company). the insured Shall also within Fourteen Days Submit Such Veterinary Certificates and Satisfactory Proof and to Furnish to the Company Such information accompanied by the Death Identity and Value of the animal as the Company May Require. the Ear-Tag Should Be Surrendered along with the above Certificates.
8. When any Claim Under This Policy Is Made and If there Is any Other insurance by Whomsoever Effectuated Covering the Same animal the Company Shall Contribute only Its Rateable Proportion.
9. If Death of the animals, Hereby insured Shall Be Due to the Negligence, Carelessness or Wrongdoing of any Person the insured Shall Not Claim or accept any Compensation from Such Person or Persons, But Shall at once Give to the Company all Necessary information and assistance to Enable the Company to Secure Such Compensation and It Shall Be absolutely the Right of the Company to Sue in the Name of the insured and Recover Compensations from the Persons Causing Death and any Monies or Other Compensation Which Shall Be Recovered Shall Belong to the Company. the Company Will indemnify the insured against, all Costs and Expenses incurred with Its Written Consent
10. The Company May Cancel This Policy by Sending Seven Days Notice by Registered Letter to the insured at His Last Known address and in Such Event Will Return to the insured the Premium Less the Prorata Portion thereof for the Period the Policy Has Been in force or the Policy May Be Cancelled at any Time by the insured (Provided No Claim Has arisen During the then Current Period of insurance) and the insured Shall Be Entitled of Return of the Premium after Deducting in Premium at the Company's Short Period Scale of Rates for the Time the Policy Has Been to force.
11. Should any Dispute arise Between the insured and the Company on Quantum of amount Payable (Liability Being Otherwise admitted), Such Dispute Will independently of all Other Questions Be Referred to the Decision of arbitrator(S) in accordance with Statutory Provision of the Country in force at That Time. Further, If / When any Dispute Is Referable or Referred to arbitration, the Making of an award by arbitrator(S) Shall Be a Condition

Precedent to any Right of action by the insured against the Company.

12. If the Company Shall Disclaim Liability in any Claim, and Such Claim Shall Not Have Been Made Subject Matter of a Suit in a Court of Law within 12 Months from the Date of Disclaimer, then the Claim Shall for all Purposes Be Deemed to Have Been abandoned and Shall Not thereafter Be Recoverable Under This Policy.
13. The Due Observance and Fulfilment of Terms Conditions and Endorsements of This Policy in So Far as they Relate to anything to Be Done or Complied with by the insured Shall Be a Condition Precedent to Liability of the Company to Make any Payment Under This Policy.

11.13 Prohibition of Rebates

The Following Is a Copy Section 41 of the insurance act 1938:

- a) No Person Shall allow or offer to allow, Either Directly or indirectly as an inducement to any Person to Takeout or Renew or Continue an insurance in Respect of any Kind of Risk Relating to Lives or Property in India any Rebate of Premium Shown on the Policy, Nor Shall any Person Taking Out or Renewing or Continuing a Policy accept any Rebate Except Such Rebate as May Be allowed in accordance with the Published Prospectus or Table of the insurer
- b) Provided That acceptance by an insurance agent of Commission in Connection with a Policy of Life insurance Taken Out by Himself on His Own Life Shall Not Be Deemed to Be acceptance of a Rebate of Premium within the Meaning of This Subsection If at Time of Such acceptance the insurance agent Satisfied the Prescribed Conditions Establishing That He Is a Bonafied insurance agent Employed by the insurer.
- c) Any Person Making Default in Complying with the Provision of This Section Shall Be Punishable with Fine, Which May Extend to Five Hundred Rupees.

11.14 Succession Planning

Small Scale Farmers Could Maintain the Family's Dairy Cattle Business from Generation to Generation, with Simple Maintenance, involving the Entire Family, including their Children, as an inseparable Part of their Lives Each Family Member's involvement Is Essential in Reducing Production Costs. Each Family Member, including Children, Has their Respective Business Duties. Children Were Considered Successors in Farming Families. as a Farming Family Member, Children Play a Role as Labour- an Essential input Factor. therefore, Children or the Younger Generation are Crucial in Sustaining Farming Families.

Thus, Succession Is Crucial in the Small-Scale Dairy Cattle Business, Predominantly Managed by Family Members. the Process of Preparing a Successor in a Dairy Farming Family Is a Challenging Endeavour.

The Succession with a Farm Takeover or Handover Occurred When the Parents Were Unable to Manage the Business Due to Illness and Getting Older, the Family Business Was in a Deteriorating Condition, or When the Parents Passed away During the Succession.

Succession Planning Is a Crucial Factor in Ensuring the Sustainability of a Family Dairy Cattle Operation. Succession Transfers Business Management to the Next Generation to Keep and Manage the Family Business However, Transitioning a Family Farm into the Next Generation Is Lengthy and intricate.

The Succession Process Highly Depends on the Decision of the Younger Generation Whether to Continue the Family Dairy Farming Business. income and Dairy Productivity are Critical Factors in attracting Successors to Work and Maintain a Family Dairy Farming Business. Farm Succession Is Significantly influenced by Factors Such as Farm Size, Previous Farm Growth, and on-Farm Diversification,

The Succession Process Could Be Complex and Emotionally Charged; Hence, It Is Essential to approach It with Sensitivity and Understanding. Successor Candidates Must Pass the Process to Continue Family Dairy Farming.

Succession Planning Encompasses a Process of Transferring Your Farm from one Generation to the Next and Requires More Than Simply Estate Planning. Most Successful Succession Plans Begin Transferring the Farm Long Before Its Current Owners are Gone.

Farm Succession Consists of Transferring Three Parts of the Business – assets, Operations and Management. Planning involves Identifying Methods by Which these Transfers Happen. assets That Need to Be Transferred Can include Land, Equipment and Cattle, as Well as Shorter Term assets, Like Feed and inventory. the Operations of a Business Generate income That Will Eventually Flow to the Junior Generation Through Business Ownership. Management involves Completing Day to Day Tasks, Make Essential Decisions and Take Responsibility for the Farm.

Tax Issues, Estate Planning, Business Viability, Financing and Proper Legal Documentation often Dominate Succession Planning and Farm-Transfer Discussions.

Succession Planning Is a Crucial aspect of any Business, and Dairy Farming Is No Exception. for Family-Owned Dairy Farms, Creating a Well-Thought-Out Succession Plan Is Essential for Ensuring the Smooth Transition of Operations from one Generation to the Next. in This article, We Will Explore the Importance of Succession Planning for Dairy Farmers and Provide insights into Creating Effective Strategies for a Successful Transfer of Leadership and Ownership.

The Significance of Succession Planning in Dairy Farming

Preserving Legacy: Succession Planning Is Vital for Preserving the Legacy of a Dairy Farm. Many Family-Owned Farms Have a Rich History and Deep-Rooted Connections to the Community. a Well-Executed Succession Plan Ensures That the Values, Traditions, and Hard Work invested by the Previous Generation are Carried forward.

Sustainable Business Continuity: Dairy Farming Is Not Just a Job; It's a Way of Life. Effective Succession Planning Ensures the Seamless Continuity of the Business, Preventing Disruptions in Daily Operations. This Is Crucial for Maintaining a Sustainable and Profitable Dairy Farm for Years to Come.

Financial Stability: Succession Planning involves Careful Financial Considerations. by addressing Issues Related to Ownership, Taxation, and Estate Planning, Dairy Farmers Can Mitigate Potential Financial Challenges During the Transition. This Helps in Maintaining the Financial Stability of the Farm and Ensuring Its Prosperity in the Long Run.

Key Steps in Creating a Succession Plan for Dairy Farmers:

Start Early and Communicate: Begin the Succession Planning Process Well in advance. Open and Honest Communication among Family Members Is Key. Discuss individual Goals, aspirations, and Expectations to Ensure Everyone Is on the Same Page. Starting Early allows for a Smooth Transition and Minimizes Conflicts.

Identify and Develop Successors: Identify Potential Successors within the Family Who are interested and Qualified to Take on Leadership Roles. Provide Opportunities for them to Gain Hands-On Experience and Gradually Take on More Responsibilities. Training and Mentoring are Crucial for Preparing the Next Generation of Dairy Farmers.

Legal and Financial Considerations: Consult with Legal and Financial Experts to address Ownership Structure, Tax Implications, and Estate Planning. Establishing a Clear Legal Framework Ensures a Smooth Transfer of assets and Minimizes the Risk of Disputes. Financial Planning Is Essential to Secure the Economic Stability of the Farm.

Document the Plan: formalize the Succession Plan in Writing. This Document Should Outline the Roles and Responsibilities of Each Family Member, the Timeline for the Transition, and any Other Relevant Details. Having a Written Plan Helps in avoiding Misunderstandings and Provides a Clear Roadmap for the Future.

Regularly Review and adjust: the agricultural industry Is Dynamic, and Circumstances May Change Over Time. Regularly Review the Succession Plan to Ensure Its Relevance and adjust as Needed. This Flexibility Is Crucial for adapting to Evolving Market Conditions, Family Dynamics, and individual aspirations.

Succession Plans Can Be as Simple as Progressively Transferring a Percent of Ownership from Senior Generation to Junior Generation. This Can Occur by the Junior Generation Buying into a Business or by Gifting them Percentages of Ownership. Under This arrangement, assets and Operations are Transferred together.

Alternatively, asset Transfer and Transfer of Operations Can Be Separated. Separating Can increase Flexibility and Optimize a Variety of available Transfer tools. a New Business Entity – often an Llc (Limited Liability Company) – Can Be Created for Operations and a Limited Set of assets. the Junior Generation Can Gain a Degree of Ownership in This New Entity, While the Senior Generation Can Retain Ownership of their Farm assets. the income from Operations Flows to all Owners of the Operating Entity, Which include the Junior Generation. This Entity then Leases, Purchases, and/Or Is Gifted Ownership of any Remaining assets.

Succession Plans Can also Be Customized by Mixing and Matching Transfer Methods. for Example, Equipment Can Be Leased, While Cows Can Be Sold in an instalment Sale. Meanwhile, Land Is often Held Through Death and Distributed to the Next Generation from an Estate. Each of these Methods Has Its Own Tax Implications. Transfer Methods and Taxes Should Be Considered in the Planning Process.

A Key Component of a Succession Plan Is That Purchasing the Farm Generates Both Financial Security for the Existing Generation as Well as an Opportunity for the Upcoming Generation to Be Successful. This Can Be Managed by analyzing a Farm's ongoing Capacity to Provide Funds for a Senior Generation's Financial Needs against Debt Payments, Taxes and Family Living. the Transfer Plan Can then Be Customized to Match Both Generation's Needs.

When Land Is the only Remaining Farm asset in an Estate, arrangements for Transfer to Farming Heirs Can Be Managed in Some Straightforward Ways. often, Farming Heirs Pay Non-Farming Heirs a Stated Value, Which Is often Lower Than Market Value of the Land. Payment Terms Have a Variety of Options, including a Lump Sum Payment or a Series of Payments Over Time.

Do Not forget Management

No Matter the Decisions about Transferring assets and income, Transfer of Management Must Not Be Ignored. Managing a Farm Requires Many Types of Tasks and Decisions. Managing Operations Is often Thought about First, But Financial, Personnel, Marketing and information Management Must also Be Considered, too. Transferring Management Can Be a Progressive Transfer of Tasks, Decisions and Responsibilities. That Transfer Can Start in one area and Progress Through Others. alternatively, Management areas Can Be Handled together with the Junior Generation Taking on More Responsibility for Decision Making Over Time.

Many Obstacles Exist for Transferring a Farm When there Is No Succession Plan. Disagreements Between Heirs on Estate assets and How to Split them Can Cause Farms to Completely Dissolve. a Succession Plan Can Make a Transfer Process Much Smoother and More Successful. any Way You Choose to Do Succession Planning, Be intentional. Determine Your Plans, Have Your Documents Written, and Fully Implement all Your Steps.

There Is an array of Professionals That Can assist in This Process. a Lawyer Is Useful in Creating Effective Succession and Estate Planning Documents. an accountant Can assist in assessing the Tax Implications.

Guiding Principles from an agricultural Consultant

in a Business Sense Succession Planning Needs to Refer to the orderly Transfer of Management, Responsibility, Ownership and Control, Over Time. in a Farm Business This Could Mean Transferring the Ownership of Some of the Machinery and/Or Livestock, Transferring the Management of Part of the Farm, and Eventually Transferring Ownership.

In order to Provide Sensible advice and Guidance It Is Necessary for the Farm Management Consultant to Understand:

- Why This Farmer Is Farming
- Why He or She Is Farming This Farm
- Why they are Farming This Farm in This Way.

In Other Words, It Is Necessary to Establish Whether or Not there are Historic Constraints Which Restrict the Choices of the Farming Family in the Way they Think about the Farm as an asset, and Whether they See It as a Business Where they're in Control or a Business Which Controls them. any Succession Plan Has More Chance of Working If the People involved Start to Think about It Earlier Rather Than Later, for instance, Building Some off-Farm assets. This Is Useful from a Risk Management Point of View and Can also Make Succession Planning Easier.

The Most Important Principles involved in a Succession Plan are:

- To Work Out What the Existing Generation Wants to Do - Where they'll Live and What they'll Do in Retirement - If Succession Is an Option

- To Identify the Needs and aspirations of Each Family Member in Each Generation
- To Build, Maintain, and If Necessary, Repair Relationships Between Family Members
- To Manage Expectations amongst Family Members
- to Look at Transferring Management and Control of the Farm Over Time
- to Sort Out How to Transfer Ownership of the Farm
- What agreement there Should Be for the incoming Generation and What Provision to Make for the Non-Farming Children.

The People involved Need to agree on a Pathway to Establish the Parents' Broad Direction, Understand the Desired Direction of all Family Members, Collect information, and Develop a Plan. a Lot of Time Is Spent Worrying about Legal Structures. Many People Get Confused When they Look at the Combination of Trust, Partnership, Company, and Sole Trader Which May Be Used. once the Size of the Task Is Understood then the Structures and the Number and Nature of Entities Required Is Reasonably Easy to Identify. No Changes Should Be Made to Ownership or Structure without accounting, Taxation and Legal advice.

Guiding Principles from an accountant

Succession Is a Complex and Important Issue for Farm Businesses. Succession Planning involves the Transfer of Ownership and Control of Farming assets to the Next Generation Charged with the Responsibility of Continuing the Business. Each Family Situation Is Unique.

Legal and accounting advice Should Be Obtained to Work Through the Succession Process.

- Communication Is the Key: the Family Might Need to Change in This Regard.
- There Is a Need for ongoing and Flexible Plans.
- All Family Members Need to Be involved.
- A Knowledge of the Current Financial Position (Profit and Loss) Is Needed. there are Four Broad Options for Legal Ownership and Trading.

Sole Trader advantages.

- Simple to Set Up and Operate.
- Low Cost to administer.
- Only answer to Self.
- Can Use Primary Production averaging System.
- Eligible for Small Business Retirement Exemptions.

Disadvantages

- Personally Liable for all Debts of the Business.
- 100% of income Is Taxed in the Hand of the Sole Trader.
- Business Ceases on Death.

Partnership advantages.

- Simple to Set Up and Operate (Have a Partnership agreement).

- Relatively Low Cost to administer.
- Can Split income Between Partners
- Potential to Pay Partner's Salary
- Partnership Losses Can Generally Be offset against Other income
- Can Use Primary Production averaging System
- Eligible for Small Business Retirement Exemptions.

Disadvantages

- Partners are Personally Liable for Business Debts
- Taxable income only Split Between Partners
- Partnership Ceases on the Death of a Partner.

Company advantages

- Can Provide Potential Limited Liability Protection
- Can Employ Shareholders and a Director - Potential for Salary Sacrifice into Superannuation
- Company Structure Continues after Death of individual (Shares Dealt with in Will)
- Company Tax Rate of 30% (If individual Marginal Tax Rates are Higher)
- Can allow for Division of Management and Ownership of the Entity.

Disadvantages

- More Expensive and Complex to Establish, administer and Wind Up
- Corporations' Law and ASIC Need to Be adhered to
- Capital Gains Tax (CGT) Small Business Retirement Exemptions Difficult to access
- Capital Gains Discounts Not available for Sale of Company assets
- Losses Must Be Carried forward
- Shareholders and Directors Need to Be Careful When Considering Spending the Company's Money.

Family Trusts

Advantages

- Split income at the Discretion of the Trustee
- Can Distribute income to Corporate Beneficiary and Use 30% Company Tax Rate
- Potential for Limited Liability If Using a Corporate Trustee
- Can Employ Family Members - Potential for Salary Sacrifice into Superannuation
- Potential asset Protection against Divorce
- Beneficiaries Can Use Primary Production averaging
- Can access CGT Small Business Retirement Exemptions

- Family Trust Continues Despite the Death of individuals.

Disadvantages

- More Costly and Complex to Establish and administer
- Must Refer to Trust Deed
- Losses Must Be Carried forward.

As the Business Becomes Larger and More Profitable there are often Significant Legal, asset Protection, and Taxation advantages to Be Gained by Changing from Sole Trader and Partnership Entities to Trusts and Companies. However, as Previously Noted, Companies Have Very Limited access to Capital Gains Tax Relief, Which Must Be Taken into Consideration. a More advanced Business Will Usually Hold Different Classes of assets in Different Legal Entities So That Land Ownership and Business Operation are Separate. Each Business Needs to Obtain Professional advice to Cater for their individual Requirements.

Small Business Retirement Exemptions

Small Business People Can Now access attractive Capital Gains Tax(Cgt) Concessions When Selling assets Like Farm Land. the Small Business Retirement Exemptions are an Important Component to Consider That Can Reduce the Taxation Burden When Selling Land or Transferring Land to the Next Generation. Four Small Business Concessions apply. these are:

- 15-Year Exemption (In Relation to Cgt)
- 50% active asset Reduction (In Relation to Cgt)
- Retirement Concession
- Rollover Relief.

Succession Planning Is an ongoing Process Which Will, Ideally, include input from Your advisers and all Family Members. aim to Get the Process Started in order to Ensure That Your Ultimate Plans for Passing the Business to the Next Generation are Smoothly Met.

Guiding Principles from a Lawyer acting in the interests of the asset Holder

Create a Plan. ask Family Members for their Views on How the Plan Should Look. ask This Question But Give No Guidance as to Your Own Thinking. Write Down all the Essentials to the Plan from Your Point of View: Time Table, Phasing in and Out, Banking Rearrangements, Housing, income Split Etc.

Take the Plan as Far as You Can by the Vigorous Exercise of Common Sense. Start Planning Five Years Before any Changes are Likely to Occur; Review the Planning at Least Every Three Years. Take advice First, Consult Your accountant for His General Views. Next, Consult a Solicitor Who Is Well Known to You or one Who Is Well Recommended to You.

The Checklist for This Meeting Should include:

- What Is the Correct Structure for Each asset? for Example, at Present a Family Discretionary Trust Is the Ideal Building Block to Hold Farming Land. Testamentary Trusts and Self-Managed Superannuation Funds May also Be appropriate Recipients of assets.

- What Is the Best Process for Transferring Your assets to the Correct Structures? avoiding Capital Gains Tax and Stamp Duty Will Be Crucial. If these Cannot Be avoided then Transfers by Will Is More Likely.
- Check That Your Planning Will Not Contravene the inheritance Family Provision act. This Legislation Gives Remedies to Dependent Children and Sometimes to Other Children Where insufficient Provision Is Made for them by Will.
- Ensure That Your Will Is Up to Date and That You Have an Enduring Power of attorney and/Or Enduring Power of Guardianship.

Control

Control Over assets or Structures Will Need to Pass the Others at the Time That Is Most Beneficial to all and at a Cost That Is affordable. Your Solicitor Will Be able to Tell You Which Means of asset Transfer or Control Transfer Can Be achieved for the Least Cost.

Communication within the Family

Some advisers Recommend Full and Open Communication at a Series of Family Meetings. It Is Wise to Have a Communications Consultant advising You or Present at Such Meetings. Full Family Meetings Can Sometimes Create Problems. a Preferable Option Might Be for the Parents to Take the Matter as Far as they Can and then for the Parents to Deal with Each Relevant Child one by one. the Purpose of the Meeting with Each Child Is to Find Out What they Think Is the Best Overall Proposal for the Parents to Consider. the intention of This Meeting Is Not for the Parents to Tell the Child anything. the Parent/S Should Paint the Picture in the Most Encouraging Colours Possible. the Children Will Need to Be Encouraged to Give their View on What Should or Should Not Occur and It Should Be Made Very Clear That they Will Not Be Penalised for Saying Something That the Parents Do Not agree with. It Is advisable to Have an Experienced Communications Consultant Present If there Is any Risk of Conflict.

Things to avoid

It Is Vital That the Succession Plans Do Not Produce Jointly Owned assets. Each Child Should Receive (By Transfer or by Will) individual assets or individual Entities Which are Not Jointly Owned with a Sibling. Passing assets and Entities (Trusts, Companies Etc) to More Than one Child Is Likely to Create Numerous Potential Legal Problems for Those Children in the Future. the Children Can always agree to Farm their assets together or with Others. to force Two or More Children to Share an asset Can Give Rise to a Range of Legal Problems Which Rarely Have an inexpensive Solution.

It Is Usually Unhelpful (And Sometimes Catastrophic) for Parents to Make Big Promises to Children Before a Properly Evolved Plan Is Prepared. to Start Promising a Teenage Son, for Example, That 'One Day You Will Own all of This' Leads to False Expectations Regarding Division of assets and the Time of Delivery, and Will Make any Future Planning Extremely Difficult If That Child Is to Derive Less Than 'All of the Farming assets'. there are Likely to Be Very Few Exceptions to This. No Promises Should Be Made to any Children - Other Than That they Will Be Fairly Dealt with - Until the Completed Plan Is Ready for Implementation. the Best Time to inform Children of Your intentions Regarding Transfer of the assets or Entities Is after all Consultations and advice, When the Plan Is Fully Worked Out and agreed to by the Parents and their advisers.

Always Look for advisers Who are Experienced in Rural Matters and Who are Practical and Encouraging, and Who Can Do So with Either Humour or without Undue Technicality. Never Hesitate to Seek the Comment of a Second or Third adviser. the Person Who Consults the 'Wrong' adviser First Up Will Save Himself a Small fortune by Consulting a Second or Maybe Even a Third adviser to Get Someone with Whom He Is More Comfortable. the Most Competent advisers Can Usually advise You in the Simplest Terms. advisers Who Feel the Need to Take You into Enormous Technical Detail are Very often Telling You the only Thing That they Know.

Guiding Principles from a Lawyer from the Perspective of the Farming Family

there are as Many Solutions to Succession Planning as there are Farming Families. Communication Is the Key. Farming Families Need to Come together and Discuss their Goals and aspirations for themselves and for the Farm Business. any Solution Must Satisfy the Needs of the Older Generation to Feel 'Secure' and also Provide the Next Generation with Motivation and a Future. a Will Is Not a Succession Plan.

Consideration Must also Be Given to Ownership of the assets and also the Management and Control of the Business. This Should include:

- A Consideration of the Current Business Structure and the alternatives to include the Younger Generation
- Remuneration of Those Who 'Work' in the Business
- Regular Business Meetings
- Transfer of Land (In Stages If Necessary) Considering Needs Such as Housing.

Some Farms adequately Support More Than one Family. Consideration Needs to Be Given to Ultimately Transferring Management and Control to the Younger Generation by Providing Sufficient off-Farm assets for the Older Generation to Retire.

The Law Is a tool to assist Families to achieve their Objectives. If there are Concerns Which Stand in the Way of Implementing Family Goals then these Need to Be addressed.

For Example:

- A Claim Being Made Under the Family Provisions act (Or Equivalent) by Family Members in or Outside the Business. Consider the Possibility of Early inheritance, Deeds of Release, Transfer Prior to Death. or
- the Risk of a Family Law Dispute within the Farming Business.

Consider the Possibility of a Binding Financial agreement or 'Clawback' Provisions Contained in the Transfer Documentation. Road Test the Will. If You Died tomorrow, What Would Happen?

Consider the Role of Life insurance. What are the Tax Implications? What are the Costs (Stamp Duty, Bank and Legal Costs)? This Should Not Be a 'Road Block'. Don't Be 'Penny Wise, Pound Foolish'.

Document the Proposal and the Decisions Made.

Review Regularly.

a Solicitor Can act for the Whole Family on the Condition That If there Was a Conflict of interest (Or If they Wished), Family Members Could Obtain independent Legal advice.

Guiding Principles from a Financial Planner

Start Planning Now. Most Difficulties in Succession Planning Can Be Summed Up in the Fact That the 'Money Bag' Is Not Big Enough to Fund all Family Members. the More That Is in the 'Bag' the More Options You Have. Identify Your Goals - What Does That Mean? Visualise Your Future, as You Would Like It to Be.

Older Generation

- When Do You Want to Retire and What Do You Think You Will Need to Live on?
- When Do You Want to Hand Over Management of the Farm?
- When Do You Want to Hand Over Ownership of the Farm?
- Where Do You Want to Live When You Retire? - on the Farm? - in the Local town (To Be Close to the Farm and Children/Grandchildren)? - in a Nearby Larger town (For the Supply of Services Such as Medical/Health)? - on the Coast?
- What Will You Do When Retired? - Will You Travel to the Farm to Help? If So, How often? - Will You Travel Australia/Overseas? If So, How often?
- What Do You Want to Leave the Farming Children?
- What Do You Want to Do for the Non-Farming Children?
- Do You Want any Debt in Retirement?
- What Is Your Estate Plan?

Younger Generation

- Is Farming What You Really Want to Do?
- Can You Work with Your Siblings? Would You Choose to?
- Have You Been Appropriately Remunerated for the Work You Have Done on the Farm?
- Can the Farm Cater for Expected Expenses Such as School Fees, Holidays, Etc Establish Your Current Position?
- What assets (Market Value) Do You Own?
- Who Owns them (What Structures)?
- What are Farm assets? What are Not (For Example awb Shares)?

Identify Strategies with advisors

Identify Strategies with advisers in order to Develop a Documented action Plan and achieve Your Goals.

The Facilitator - to Help You Set the Vision - Particularly If the Children are Older/Grown Up, You Will Need to Consider their Vision.

The accountant - to Help You Determine Your Current Position and Structures. the accountant Helps You to Consider all Possible Strategies in Relation to Current Taxation Laws. accountants Can assist with Planning Funding for the Successful Execution of Your Vision, Making Sure That

the Farm Is Not Unsustainable in the Future. the accountant Should also Consider Not Just the Best Structure for today, But also the Best Structure for the Future.

The Financial Planner - to Help You Determine the Costing of Your Vision and Other Strategies to Do with Superannuation and investments.

The Solicitor - to Be involved in What Is and Is Not Possible Legally (In Terms of anything You Do today and also anything You Do in Your Estate Plan). all of these Parties Will Give advice. with their advice and Support You Can Devise a Plan That Helps You Reach Your Vision and Gives You Peace of Mind.

Guiding Principles from a Facilitator

Why Use a Facilitator?

- Often the advisers to a Business are Closely aligned with the Current Operators.
- A Facilitator Provides independence, Objectivity and Control.
- It Might Be Difficult for a Family Member to Facilitate a Succession Meeting as they are a Stakeholder and a Family Member, with their Own Views and Opinions.

How Do You Choose a Facilitator?

- You Need to Feel Comfortable with their Experience/Endorsement.
- You Need to Feel That they Will Create a Safe Environment Which Enables Openness and Effective Communication.
- The Facilitator Needs to Have indemnity insurance.
- The Facilitator Needs to Have Professional and Clinical Support.

Who Comes to the Meeting?

- All Stakeholders Should attend the Meeting. all Family Members are Potential Stakeholders in the Estate and are therefore Impacted by Succession Decisions in the Business. in-Laws and Long-Term Partners Living and/Or Working on the Farm are also Stakeholders.
- The Risks of Not including all Family Members Need to Be Understood.
- The accountant of the Business Is a Valuable addition to the Meeting for the Provision of Taxation and Business Structure advice, and for the Purpose of Generating Options.

Where Is the Meeting Held?

- Preferably in a Neutral Place, off-Farm Where there are No Distractions.
- External Catering Is Important.

How Long Does the Meeting Take?

- It Is Usual for a Meeting to Last 6 to 8 Hours
- It Is Important to Understand That a Meeting Is one Part of a Complex Process. another Meeting May Be Required; It Might Take a Considerable amount of Time for Decisions to Be Implemented.

What Should Be achieved?

- Clarification of Every Stakeholder's Goals.
- An Opportunity to Reach agreement and to Take the Next Step.
- Points to Remember
- Compromise Is Important.
- Each Family's Position Is Different and therefore Each Outcome Will Be Different.

Guiding Principles from a Generation Consultant

Points to Remember When Dealing with Different Generations

- Differing Work Ethics
- Different Perspectives on Work
- Distinct and Preferred Ways of Managing
- Unique Ways of Viewing Quality
- Different Priorities That Effect How and When they Show Up for Work.

11.15. Training in New Technology Driven activities.

I. Training Programs for Farm Staff

To Develop the Capacity and instil the Required Skill in the Farm Staff, they Must Be Exposed to Various Training institutions and Capacity Building Programmes Which Would Enhance their Knowledge and Upgrade their Skills.

Thus, the Development of Knowledge, Skills and Competencies among Dairy Farm Workers Be It Family Members or Newly appointed Farm Managers, the Trainings are Designed:

- I. to Become an Efficient Dairy Farm Manager and Managing Staff and Grow the Dairy Business.
 - i. To Get acquainted with the Management, Operation & Business Plan for a Dairy Farm
 - ii. To Learn How to Handle Pressures and Bring Out ability to Plan and organize the activities for Effective Management of Farm
 - iii. To Enhance the Business Communication Skills
 - iv. Better Understanding of Risk Management & Quality Parameters for Dairy industry
 - v. To Learn a Software-Based Herd Management, inventory Management and Record Keeping activities on Virtual/ online Mode
 - vi. To Get Hands on Training on Dairy Processing and Illustrations on Troubleshooting in Various Dairy Product Preparations on Commercial Level
 - vii. To Become a Leader and Learn Strategic Management of a Team at Dairy Farm.
 - viii. To Understand indigenous and Desi Cattle Breeds and their Management
 - ix. To analyze Safe and Hygienic Practices for animals and Dairy Workers for Better animal Health
 - x. To Understand Best Practices for Selection of Bull, Semen Extraction and artificial insemination
 - xi. To Understand onset of Various Diseases and Preventive and Curative Measures

Thus, there Is a Need for Continuous Education on New Techniques and Technologies.

ii. Training of the Family Members .

Training the Family Members Starts at a Very Early age of the Children as they Grow Up Being Part of the Farmer's Family. they Learn Every aspect of Dairying from their Parents. Most of the Children Help their Parents with the Farm activities. Though Some of them Go Out for their Higher Studies and Employment, While Daughters Either Go Out for Employment or Married off. However, If the Family Members Take Over the Farming after their Parents' Life-Time, they are Naturally inclined to Carry Out the activities with Much Ease and Do Not Undergo any Special Training. they Undergo Specialized Relating to adoption of New Technologies to Enhance their Existing Knowledge.

11.16. Employee Wellness and Motivation

In Well-Managed Dairy Farms, Dairy Workers Need to Be Protected from injury or Impairment of any Bodily Function That Might Occur Due to absorption or inhalation of Harmful Elements, or Even by Physical Contact with Diseased animals. Safety Measures are to Be Deployed for the Wellness and Motivation of the Farm Employees.

I. Personal Protective Equipment (Ppe)

The Dairy Workers Should Wear Protective Clothing and adequate Protective Equipment While Carrying Out Day-To-Day Operations. Risks During animal Handling, Feeding or Milking or Other Routine Operations Can Be Minimized by Using Personal Protective Equipment (Ppe) by the Farm Workers.

ii. Gloves

Gloves Helps to Protect the Hands from Contact with Hazardous Substances, Hot or Cold Surfaces, Stings, Rough Textures or Sharp tools

iii. Safety Shoes or Gumboots

Gumboots are to Be Used in Dairy Farms for Various Routine Farm activities. Gumboots Protect the toes and Legs of the Farm Workers from injuries by Being Stampeded by animals. Gumboots also Provide Protection from Snake Bites, Slippery Surfaces, Sharp Item Penetration, Water Penetration, Etc.

iv. Goggles

Goggles Protect the Eyes from Dust and Straw Particles and Fumes. they are to Be Used During Weeding, Welding, Cutting and While Working in the Workshop.

V. Earplugs and Earmuffs

Earplugs and Earmuffs Protect the Farm Workers from High Noise Levels Emitted from Machines, Such as Chainsaws, or animals, Such as Pigs, When Housed.

Vi. Face Protection

It Is Used While Welding, to Protect the Eyes, Nose and Mouth from Fumes, Heat and Stray Metal. Face Protection Must also Be Worn While Mixing, Spraying or applying Chemicals or Using Solvents, and also While Grinding Metal or Cutting Timber.

12. FINANCIAL PLAN

12.1. Financial Management

Financial Management Is Used to Help achieve Objectives, to Help Identify Priorities and to Improve Capital Use by Providing the Limits within Which Decisions May Be Made. Production and Marketing Skills Generate Profitability Directly, Whereas Financial Management Serves More to Conserve That Profit. So, Management Time Must Be Budgeted in order to Generate Profits, But there Is Good Reason to Expand Familiarity with Financial Management. Weaknesses in Production and Marketing Skills are Less Easily Identified Than Weaknesses in Financial Management. If the appropriate Financial Statements are available, then Financial Weaknesses are Easy to Spot. Having Identified Financial Weaknesses, the Concentration initially Is on aligning Debts with Repayment Capacity. attention then Turns Back to What Can Be Done in Production and Marketing in order to Improve Profitability.

Balance Sheets are Necessary to Tell How Much of the Business Is Owned, How Much Collateral Can Secure additional Borrowing. income Statements Show Whether the Business Was Profitable or Not, and Can Be Used to Estimate Debt Servicing ability. Cash Flow Plans Show How Much and When Money Flows Through the Dairy, and Helps Test the Feasibility of Changes That Might Be Made in the Dairy. in Essence, Balance Sheets Measure What there Is to Work with, income Statements Tell Whether Enough Money Is Being Made to accomplish Objectives, and Cash Flow Plans Serve as a Financial Road Map. Used Well, they Help Keep a Dairyman from Borrowing More Money Than Can Be Profitably Used, Repaid, and accomplish the Overall Objectives. Good Dairy Management Is What Makes the Profits. Financial Management Helps Protect That Profit and Helps Keep Dairymen from Digging a Deeper Financial Hole. Successful Dairymen Have Carefully Monitored their Financial Progress and Expanded only When they Were Financially able to Make a Major Move.

I. Balance Sheet

Financial analysis Is anchored on Each End by the Balance Sheet. It Gives a Stop-Action Look at the Financial Situation at the Beginning and End of the Year. in Between, income Statements Detail income and Expenses. these are Tied Closely to the Cash Flow analysis, Which Monitors Cash Coming into the Business and How It Is Used. Data Collected from Keeping Good Records Helps one

- To Set Goals for the Future,
- Make the Management Decisions Needed to achieve Those Goals, and
- Track Financial Progress toward Those Goals along the Way.

Assets Can Be Financed with Borrowed Money (Debts or Liabilities) or with Equity Capital or Net Worth. total assets Must Balance with Liabilities Plus Net Worth, Hence the Name Balance Sheet. When Net Worth Is Gone, the Business Is Operating Completely on Other People's Money, and It Is Broke, So Net Worth Measures the Distance to Bankruptcy. Year -End Balance Sheets Tell Where the Business Stands Going into the Next Year. another Year, and another Balance Sheet Tells the Financial Condition then. the Difference Between the Two Shows How Much Financial Progress Was Made During the Year.

II. income Statement

the Classic income Statement Would Show Farm income and Expenses Divided into Three Sections:

- Cash Operating Statement,
- Adjustments for inventory Changes, and
- Adjustments for Capital Items.

Big Savings Can only Come from Big Ticket Items. as Expected, the Biggest Is Feed. interest Is Next and Improvements there Imply Some Debt Replacement or Restructuring. Labour and Repairs are Other Relatively Large Expense Items That Might Suggest a Review of Management Practices in Those areas. Milk Hauling Is one Expense That Needs to Be increased.

III. Budgets

Budgets offer the Best Hope for Providing Some Sort of Comparative analysis. a Budget Shows an Estimate of Economic Cost of Facilities and Equipment in addition to the income and Expense Data Provided. Thus, an individual Could Compare His Costs and a Crude Estimate of Profitability to a Budget for His Type Operation. Budget information, or More Precisely, Budget Projections, are a Must Before Making Some Ma Jor Change Such as adding a Silage Operation.

Summary:

Financial Plan Should include 5-Year Financial Statement Broken Out Both Monthly or Quarterly for the First Year and then annually. Financial Statements Should include income Statement, Balance Sheet and Cash Flow Statements.

Income Statement: an income Statement Is More Commonly Called a Profit and Loss Statement or P&L. It Shows Revenues and then Subtract Costs to Show Whether You Turned a Profit or Not.

In Developing Your income Statement, You Need to Devise assumptions. for Example, Will You Start with X Number of Cows or Will You Expand Your Cow inventory Slowly? and Will Sales Grow by 2% or 10% Per Year? as You Can Imagine, Your Choice of assumptions Will Greatly Impact the Financial forecasts for Your Business. as Much as Possible, Conduct Research to Try to Root Your assumptions in Reality.

Balance Sheets: Balance Sheets Show Your assets and Liabilities. While Balance Sheets Can include Much information, Try to Simplify them to the Key Items You Need to Know about. for instance, If You Spend Certain amount of Money on Building Out Your Dairy Farm, This Will Not Give You Immediate Profits. Rather It Is an asset That Will Hopefully Help You Generate Profits for Years to Come. Likewise, If a Bank Writes You a Check for Certain amount of Money, You Don't Need to Pay It Back Immediately. Rather, That Is a Liability You Will Pay Back Over Time.

Cash Flow Statement: Your Cash Flow Statement Will Help Determine How Much Money You Need to Start or Grow Your Business, and Make Sure You Never Run Out of Money. What Most Entrepreneurs and Business Owners Do Not Realise Is That You Can Turn a Profit But Run Out of Money and Go Bankrupt.

In Developing Your income Statement and Balance Sheets Be Sure to include Several of the Key Costs Needed in Starting or Growing a Dairy Farm:

- Cost of Dairy Farm Construction and Barn Build-Out
- Cost of Dairy Farm Supplies, Cows, and Equipment
- Cost of Marketing the Dairy Farm
- Payroll or Salaries Paid to Staff
- Business insurance
- Taxes and Permits
- Legal Expenses

12.2. Record Keeping -Mis – Data Capturing formats/Practices

Record Keeping Is a Necessary Element of Good Livestock Business Management. with No Written Records, Farmers Must Depend on their Memory While Making Decisions Regarding their Farm Practices. But Memories Can Become Unreliable after a Few Days, Months or Years.

Thus, Recording of the Performances of the animals Can Be Done Easily If animals Have Some Identifications / Numberings. Thus, Both animal Recording and Identification are always Required. there are Several Useful Records Such as Production and Financial Transactions in the Dairy Enterprise. If We Know What Is Happening on the Dairy Farm We Need to Maintain Some Useful Farm Records. Farm Records are Like the Progress Report Cards Students Get at School. If Farmers Have Farm Records, they Can Tell How Well they are Managing their Farm in Comparison to Other Farmers. they Can also See the Strengths and Weaknesses in their Farm Operations. It Is also Important to Have accurate Facts and Figures When Borrowing Money, Seeking Government Loans and Tax Returns.

Advantages of Record Keeping at Farm

- Records Provides Basis for Evaluation of animals from Past Records Hence Helps in Selection and Culling animals .
- Helps in Preparing Pedigree and History Record of animals. .
- Helps in assessing the Past Records and Designing Better Breeding Plans to Check inbreeding, Selecting Superior Parents and Helps in Better Replacement and Culling Practices. .
- Helps in Progeny Testing of Bulls. .
- Helps in analysing Feeding Cost and Benefits from animal Product Outputs. Hence Helps to formulate Economic Feeding Strategies for Optimal Productions. .
- Helps in Detection of abnormal Conditions or Disease Status of the Herd That Leads to Loss in Body Weight, Loss in Milk Production Etc. .
- Helps in Finding the Commonly Occurring Diseases in the Herd and Thus to formulate in Time Precautionary Measures Like Vaccination, Deworming Etc. .
- Helps in Fixing Proper Prices of animal Meant for Purchase and Sale. .
- Helps in Overall Better Supervision and Management of Herd. .
- Helps in ascertaining the income and Expenditure (Economics) of Dairy Farm. . Helps in Estimating the Cost of Milk Production. .

- Helpful in Comparing the Efficiency of Labour and Herd with Other Farms. .
- To Compare the Herd Performances in Different Years to Determine the amount of Profit/Loss Each Year and Setting Future Goals/Directions for the Farm.

12.3. Types of Records to Be Maintained at a Dairy Farm

1. Livestock Register: This Register Records the Number of the animals at the Farm along with their Identification Number, Date of Birth, Sire Number, Dam Number, Calf and Its Sex, Date of Calving, Date of Purchase, Date of Sale/Auction/Death.

Livestock Register								
Animal Id	Date of Birth	Sire Number	Dam Number	Calf Id	Calf Sex	Date of Calving	Date of Purchase	Date of Sale/Auction/Death
1	15-03-2022	123	456	001a	Female	01-05-2022	01-05-2022	-
2	20-04-2022	789	101	002a	Male	10-06-2022	10-06-2022	-
3	10-02-2022	222	333	003a	Female	25-03-2022	25-03-2022	-
4	05-05-2022	444	555	004a	Female	20-07-2022	20-07-2022	-
5	30-01-2022	666	777	005a	Male	15-03-2022	15-03-2022	-

2. Calving Register: This Register Maintains the Records of Calving That Take Place in the Farm. It Maintains Dam and Sire Number of the Calf, Calf Number, Sex and Its Date of Birth and any Other Remarks Like Type of Calving (Normal/Abnormal).

Calving Register						
Dam Number	Sire Number	Calf Number	Calf Sex	Date of Birth	Type of Calving	Remarks
123	456	001a	Female	01-05-2022	Normal	-
789	101	002a	Male	10-06-2022	Normal	-
222	333	003a	Female	25-03-2022	Abnormal	Difficult Birth
444	555	004a	Female	20-07-2022	Normal	-
666	777	005a	Male	15-03-2022	Normal	-

3. Daily Milk Yield Register: This Register Records the Daily Milk Yield Performance of the Cows.

Daily Milk Yield Register				
Date	Cow Id	Morning Milk Yield (Litres)	Evening Milk Yield (Litres)	Total Milk Yield (Litres)

7. Herd Health Register: This Register Maintains the Record of the Diseased animals along with History, Symptoms, Diagnosed Disease, Treatment Given and Name of the Veterinarian Who Treated.

Herd Health Register						
Date	Animal Id	History	Symptoms	Diagnosed Disease	Treatment Given	Veterinarian
01-04-2022	1	Loss of appetite, Fever	Reduced Milk Yield, Lethargy	Mastitis	Antibiotics, Udder Massage	Dr. Smith
02-04-2022	2	Coughing, Nasal Discharge	Difficulty Breathing, Fever	Pneumonia	Antibiotics, Supportive Care	Dr. Johnson
03-04-2022	3	Lameness in Hind Leg	Swelling, Heat, Pain	Arthritis	Anti-Inflammatory Drugs	Dr. Williams
04-04-2022	4	Diarrhoea, Dehydration	Weakness, Lethargy	Enteritis	Fluid therapy, Electrolytes	Dr. Brown

8. Cattle Breeding Register: This Register Maintains the Details of Breeding Practices in the Farm Such as Cow Number, Date of Calving, Date of Heat and Services along with the Bull Number, Date of Successful Service, Pregnancy Diagnosis Records, Expected Date of Calving, actual Date of Calving, Calf Number Etc.

Cattle Breeding Register									
Cow Number	Date of Calving	Date of Heat	Bull Number	Date of Service	Pregnancy Diagnosis	Expected Date of Calving	Actual Date of Calving	Calf Number	
1	01-01-2022	15-12-2021	123	16-12-2021	Positive	25-09-2022	22-09-2022	001a	
2	05-02-2022	25-01-2022	456	26-01-2022	Negative	-	-	-	
3	10-03-2022	28-02-2022	789	01-03-2022	Positive	18-11-2022	-	-	
4	-	15-04-2022	101	16-04-2022	-	-	-	-	

9. Animal History Sheet: This Maintains animal Number, Breed, Date of Birth, Sire and Dam Number, Lactation Yield Records, Date of Drying, Date of Disposal/Death, Cause of Disposal Etc.

Animal History Sheet									
Animal Number	Breed	Date of Birth	Sire Number	Dam Number	Lactation Yield Records	Date of Drying	Date of Disposal/Death	Cause of Disposal/Death	
1	Holstein	15-01-2021	123	456	[Records]	01-02-2023	-	Sold	
2	Jersey	20-03-2021	789	101	[Records]	-	-	-	
3	Guernsey	10-12-2020	222	333	[Records]	15-04-2023	10-05-2023	Disease	
4	Holstein	05-02-2022	444	555	[Records]	-	-	-	

12.4. Financial Records- Cash Flow, income, Expense Statement Profit and Loss a/C of the Farm

Income

Income Is all the Money Earned by the Dairy Business for the Year.

Income Can Be Either Cash or Non-Cash. Milk and Livestock Sales account for Most of the Cash income, Whereas the Change in Value of Livestock Over the Year Is Noncash income. income from the Dairy Business Contributes to Either Farm Cash income or Gross Farm income. Farm Cash income Is the total Cash income Earned by the Dairy Farm Business in the Reporting Period and Is Used in the Cash Report. Gross Farm income Is the total Cash and Non-Cash income Earned by the Dairy Farm Business in the Reporting Period and Is Used in the Profit Report. income Is Reported Excluding Gst

What to include

- Cash income
- Milk Sales – Net of Transport, Stop Charges and Levies
- Net Livestock Sales Minus Livestock Purchases
- Sales of Temporary Water
- Home Grown Fodder or Grain Sales
- Dividends from Shares – only If they are Essential for Doing Business, for Example, Milk Company Shares
- Interest Earned on Farm accounts
- Rental from Farm Houses
- Non-Cash income
- Changes in Number and Value of Stock. Use a Livestock inventory to Capture the Value of all Livestock Sales Minus Purchases (Net of any Transport, Commissions, and Levies) and the Change in the Number and Value of Livestock Over the Year, Through Births, Deaths and Live Weight Gain.
- A Decrease in the Value of Livestock Is Recorded as a Negative, an increase as a Positive

What to Leave Out

- Income from Government Subsidies or Non-Farm Related income, income Support Payments and Child allowance
- Income from Sale of Capital Items Such as Land or Machinery - This Is Captured in a Balance Sheet and the Cash Report
- Proceeds of Loans Taken Out During the Year - This Is Captured in a Balance Sheet and the Cash Report
- Changes to the Capital Values of the Farm assets Land, Machinery and Herd or Permanent Water Shares – This Is Captured in the Wealth Report
- Income That Is Not Generated by the Operations of the Dairy Business E.G. Beef Cattle Sales, Dividends from Shares, a Partner's income Earned away from the Farm, insurance Claims.
- Personal income from Tax Refunds, Gifts or inheritance, Medical Rebates, and Hobbies.

Variable Costs

Herd, Shed and Feed Costs

Variable Costs Vary in Line with the Size of the Enterprise.

They are Separated into Herd, Shed, and Feed Costs and Help to Estimate the Impact of Changes to Milk Production, Herd Size or Season on Costs. adding Herd, Shed and Feed Costs together Gives total Variable Costs. Variable Costs are included in Both the Cash Report and the Profit Report. Variable Costs are Recorded Excluding Gst

Herd Costs

What to include

- Artificial insemination (Ai) and Herd Test – including ai Technician, Semen, Gloves, Nitrogen for Semen Tank, Herd Test Charges, Cow, and Heifer Identification.
- Animal Health – Drench, Drench Guns, Lice and Parasite Treatment and Prevention, Vaccines, injections, Drugs and Other Treatments, Teat Sealants, Vet Fees and Services
- Calf Rearing – Milk Powder, De-Horning, Drenching, Grain, Pellets, Straw, and Treatments for Calves Up to the Time they are Weaned.
- Short-Term Leasing of Bulls and Cows Could Be allocated Under Other Herd Costs.
- What to Leave Out
- Capital Purchases of Stock or Equipment, for Example, New Crush or Drafting System.

Shed Costs.

What to include

- Electricity – Electricity, Gas, Fuel for Heating, Cooling, Lighting, and Milking
- Dairy Supplies – Rubberwear, Filter Socks, Vacuum Pump Oil, Milking Gloves, Plant Cleaning Chemicals, Sanitisers, Teat Spray.

What to Leave Out

- Repairs and Maintenance to the Dairy as these are Overhead Costs and Electricity for Irrigation, Which Needs to Be included Under Irrigation Expenses.
- If You Have one Electricity Meter for House and Dairy, include an Estimation of the Dairy Power Usage.
- Feed Costs
- Feed Costs are the Most Significant Variable Cost and are Usually the Largest Cost for a Dairy Business. It Is Useful to Separate Feed Costs into Those Related to Home-Grown Feed, and Those Related to Purchased Feed.

Home-Grown Feed Costs

What to include

- **Fertiliser:** all N-P-K-S Fertilisers and Trace Element Fertiliser Products and Compounds including Blending, Mixing, Cartage, Bin Hire and Spreading
- **Irrigation:** Water Costs, including Water Rights and Sales, Temporary Transfers, Pumping Costs, Repairs to Irrigation System, Rates for Supply and Drainage.

- **Hay- and Silage-Making:** for on-Farm Hay- and Silage-Making, including Twine, Plastic Wrap, and Contractors.
- **Pasture and Cropping:** Costs associated with Pasture Renovation and Cropping, Such as Seed and Contractor Costs. Chemicals and Contractors for the Control of Weeds and Pests in Pastures, Channels, and Roadsides Etc.
- **Fuel and Oil.**
- Agistment and Short-Term Land Leases or Rental (Less Than 12 Months), Contract Rearing of Replacements after Weaning, Cartage to and from agistment.

Purchased Feed Costs

What to include

- Purchased Fodder: Bought in Hay, Straw, and Silage
- Concentrates: Bought in Grain, Protein Meals, Pellets, and Other Concentrates. Lead Feeds, Such as Springer Pellets, anionic Salts, and Heifer Pellets Post Weaning
- Other Feed: Purchased by-Products Used as Feeds, Such as Brewers' Grain, Citrus Pulp, Grape Marc.
- Other Feed Costs: including Feed additives, Such as Minerals, Rumen Buffers or Modifiers, Probiotics. Grain Processing Costs and the Cost of Washing Out or altering Grain Contracts and Cartage Costs Not already accounted for.
- Note: Purchased Feed Costs are the Cost Delivered on Farm including Freight.

What to Leave Out

- Repairs and Maintenance on Tractors, Feed Wagons, Feeding Systems or Other Equipment – these are Overhead Costs
- Labour Costs for Work Related to Growing Feed Except for Contract Labour Brought in for That Specific Task, Such as Silage Making or Fertiliser Spreading. Contractors Use their Own Gear and organise their Own Work Schedule.
- Lease Costs on Land Used as Part of the Dairy Business, Which Is Leased for More Than 12 Months. Lease Costs are included as a Finance Cost.

Feed and Irrigation Water inventory Changes

Feed and Irrigation Water inventory Changes are Classified as a Feed Expense Under Variable Costs. This Is the total Opening Value of Feed and Water on-Hand Less the Closing Value of all Feed on-Hand and Water 'Carried Over' into the Next Year. an Expense Here Means You Have Depleted Your Feed Reserves and Utilised Some of them as Feed Throughout the Year. Where This Shows as a Negative Expense Item This Means You Have increased Your Feed or Water inventory Over the Year and This increase Is offset against the total Feed Expenses for the Year.

Calculating Feed Costs Per tonne

a Business analysis Combines the Dollars Spent on Feed Costs with the Physical amounts of Feed Used from the Feed inventory, and the Estimated Pasture Consumption, to Calculate the Costs Per tonne Dry Matter of all Feeds Used. This Is a Useful Measure When Making Decisions about What Feeds to Purchase, and Whether to Conserve Home-Grown Fodder or Buy It in.

The Physical Report Provides an Estimation of Feed Costs Per tonne of Dry Matter for Both Home-Grown and Purchased Feeds.

For Purchased Feeds, the Calculation Is Simple:

Total ₹ Spent on Purchased Feeds ÷ tonnes of Feed Purchased (In Dry Matter)

For Home-Grown Feeds, the Calculation Relies on Some Estimations and assumptions, to Determine the amounts of Feed Grazed and Conserved and the approximate Costs of Each.

For Grazed Feed: total ₹ Spent on Growing Feed ÷ the Estimated tonnes of Feed Grazed (In Dry Matter)

For Conserved Feed: total ₹ Spent on Harvesting and Conserving Feed ÷ tonnes of Fodder Conserved (In Dry Matter)

Overhead Costs

Overhead Costs are the Costs That are incurred When Operating a Dairy Business, But are Not Directly Related to the Size or Production on the Farm.

They include administration, insurance, Land Rates, Paid and Imputed Labour, Professional Fees, Repairs and Maintenance and Depreciation.

Overhead Costs Can Be Cash Overheads and Non-Cash Overheads. Non-Cash Overheads include Imputed Labour and Depreciation.

Total Cash Overheads are Used in a Cash Report.

Total Cash and Non-Cash Overheads are Used in a Profit Report.

What to include

Cash Overhead Costs

- Rates: Shire Rates and Charges, Domestic Water Rates, Where applicable.
- Registration and insurance: insurance for Farm Vehicles, including Comprehensive insurance. Farm insurance for Stock, Plant, Fodder, Buildings, Sickness, accident and Trauma.
- Repairs and Maintenance for Farm Improvements, including Buildings, Fences, Yards, Irrigation Structures, Laneways, Plant, and Equipment.
- Paid Labour: Wages, Workcover, Superannuation, Staff amenities, Paye Tax, Training, Protective Clothing, and Sharefarmer Costs.
- Other Overheads: Telephone, Professional advice, Subscriptions, Postage, accountancy Fees, Donations, Waste Removal, and Bank Charges.
- Non-Cash Overhead Costs
- Non-Cash Costs, or Imputed Costs, are an Estimation in the absence of a Real Cash Cost allowing Comparisons Between Years and Other Businesses.

There are Two Common Non-Cash Overhead Costs:

Depreciation

This accounts for the Loss in Value of assets Such as Machinery and Equipment, Over Its Expected Reasonable Working Life. If an asset Has an Expected Working Life of 10 Years, the annual Cost of Depreciation Is 1/10th or 10 Per Cent of Its Value.

Depreciation Used for Dairy Profit analysis Is Different to That Calculated by an accountant for Tax Purposes.

To Calculate Depreciation, Make a List of all the Plant, Machinery and Major Equipment on the Farm and Estimate the Market Value at the Start of the Financial Year, This Is the Opening Value.

Uses a Standard Rate for Depreciation of 10 Per Cent Per Year across all Plant and Machinery, Unless You Choose to Enter Your Own Figure. This Will Be a Bit too High for Some Gear Like Seeder's or Spreaders and a Bit too Low for Quad Bikes and Feed Wagons, But on average Will Give a Reasonably Good Estimation across the Board.

The Closing Value Is Calculated by Taking the Opening Value and Deducting the 10 Per Cent for Depreciation. This Closing Value Becomes the Opening Value for the Next Financial Year. the Depreciation Is the Dollar Value of the 10 Per Cent Reduction in Value.

For New Equipment Bought During the Year, add in to the List at the Cost Price, and then Depreciate the Value according to How Many Months It Has Been Owned. for Equipment Sold or Traded, Remove from the List, and adjust the amount of Depreciation accordingly.

Imputed Labour Cost

This Is the Value Put on any Work Carried Out in the Business That Is Not Directly Paid for by Wages or Salary, Such as from Farm Owners and Family Members. It Is Usually assigned an industry agreed Cost Based on an Hourly Rate for Time Worked.

To Calculate, Record the Hours Worked Each Week by People That are Not Paid and Multiply by the Number of Weeks Worked in the Last Year. This includes a Sharefarmer Who also Has assets in the Business, Such as Cows or Machinery. This Will Give the total Hours of 'Unpaid' Work.

Multiply the Number or Hours by an agreed Hourly Rate for the Value of the Work,. Has a Set Hourly Rate for Imputed Labour for Each Financial Year Which Cannot Be Overridden.

What to Leave Out

- Financing Costs: interest Payments, Lease Costs, Principal Repayments on Loans and Credit Cards
- Capital Purchases for New Machinery, Livestock, or Other assets
- Tax Payments

12.5 Cost of Production

Calculating the Cost of Production Is a Basic Step to Understanding a Dairy Business. Whilst Milk Is the Main Product, Dairy Farming also Produces Livestock and Feed from the Same inputs. So, When analysing the Business, the Cost of Production includes the Cost of Producing Milk, Livestock, and Feed. Cost of Production Is Usually Expressed as ₹/Kg Milk Solids or Cents/Litre.

There are Three Levels to Calculating Cost of Production:

12.6 Farm Working Expenses (Fwe)

These are all the Direct or Cash Costs That Have Been incurred During the Year, including:

Variable Costs Herd, Shed and Feed Costs

Cash Overhead Costs administration, Repairs and Maintenance, Paid Labour

Fwe = Variable Costs + Cash Overhead Costs

Fwe in ₹ Per Kg Milk Solids = Fwe ÷ total Milk Solids Produced

This Measure Is Found in the Cash Report.

Farm Working Expenses Is a Useful Measure to Identify the Cash Costs of Production and Prepare Cash Low Budgets. It Can Help in Short Term Planning and adjusting to Changes in input Costs or Milk Price.

12.7 total Operating Costs (Toc)

This includes all the Cash and the Non-Cash Expenses incurred During the Year, including:

Farm Working Expenses all the Cash Variable and Overhead Costs Described above. Plus, an adjustment for Changes to Feed and Water inventory:

Imputed Labour This Is the Value of the Hours Worked by the Farm Owners or Operators, and Family Members, Who are Not Paid a Wage or Salary for their Time.

Depreciation This Is the Calculated Cost for the Loss in Value of Plant and Machinery Used to Run the Business.

Toc = Variable Costs + Cash Overhead Costs + Imputed Labour + Depreciation +/- Feed and Water inventory

Toc in ₹ Per Kg Milk Solids = toc ÷ total Milk Solids Produced

Cost of Production (Cop) including inventory Change

The Difference Between the total Operating Costs and the Cost of Production (Including inventory Change) Is That an adjustment Is Made for Livestock inventory and Livestock Purchases. in a Steady State System Where there Is No Change to Livestock inventory the Cost of Production (Including inventory Change) and total Operating Costs Will Be the Same.

Cop (Including inventory Charges) = Variable Costs + Cash Overhead Costs + Imputed Labour + Depreciation +/- Feed inventory Changes +/- Livestock inventory Changes (Closing Value - Opening Value – Purchases)

This Measure Is Shown in the Profit Report.

Cost of Production (Cop), including inventory Change, Is the Most accurate Measure of Cost of Production as It Takes into account the Impact on Costs Caused by Significant inventory Changes. It Is Particularly Relevant for Farms That are in a State of Change.

What to Leave Out

Finance Costs, Leasing Costs, Principal Repayments, Capital Purchases, Personal Drawings, Tax Payments are Not included in Cost of Production.

Caution with average Costs It Is Important to Understand That the Cop in a Report Is an average of all Costs Spread across all the Units of Production for the Year. average Figures Give a Useful Summary of Whole Farm Costs, and Give a Ballpark Picture of Farm Performance. However, average Figures Should Not Be Used to Predict What the Implications Would Be for Making Changes to the Business Operation, Such as increasing or Decreasing Milk Production. these Decisions Need to Consider a Marginal analysis Using Marginal Cost of Production, Rather Than average Cost.

12.8 assets, Liabilities, and Equity

Assets

Assets are all the Resources Used to Operate a Dairy Farm Business, including Both Owned and Leased assets.

Assets include:

- Land and Buildings, including Improvements Such as Fences, Stockyards, Water Troughs and Hayshed's
- Permanent Water Rights, Which Depending Where You Farm, May or May Not Be Separated from the Land Title
- Plant and Equipment, including Tractors and Machinery, Milking Equipment and Vats, Irrigation Plant and Farm Vehicles
- Livestock
- Feed on-Hand
- Cash and Farm Management Deposits
- Milk Company Shares. for Business analysis, assets are Separated into Current and Non-Current assets.

Current assets are Cash or Other assets Expected to Be Converted to Cash within a Year. they include accounts Receivable, Prepaid Expenses, Farm Management Deposits and Feed on Hand.

Non-Current assets are assets That are Likely to Be Held for at Least a Year and are Not as Easily Converted to Cash, or Not Expected to Become Cash within the Current Year. Examples include Land, Buildings, Livestock and Plant and Equipment.

Valuing assets for Business analysis, all assets Must Be assigned a Value. When Valuing assets, Use the Current Market Value If You Were to Sell within Reasonable Timelines. You Need to Be Realistic, and Consider average Values Over Time, Rather Than the Highs and Lows That Can Occur.

Liabilities

Liabilities are the Debts Owed by the Business. Liabilities are Separated into Current and Non-Current Liabilities.

Current Liabilities: Money Owed by the Business on a Short-Term Basis, and Generally Due to Be Repaid within one Year. for Example, an Overdraft or Credit Card Debt, accounts Payable and Milk Payment advances.

Non-Current Liabilities: Money Owed by the Business and Not Due to Be Repaid within the Next Year. for Example, Term Loans, Lines of Credit, Lease or Hire Purchase on Plant and Equipment Longer Than a Year.

Equity

Equity Is the total Value of the Business That the Owners Own. It Is also Known as Net Worth, Owner's Capital, or Wealth.

Equity = assets Minus Liabilities

Measures of Equity

Equity Is Measured in total Dollars and Is Commonly Expressed as a Percentage of all Owned assets.

Equity % = Equity ÷ total assets Owned X 100

Equity Percentage Is Commonly Used by Banks When assessing the Security and Borrowing Capacity of the Business. Banks Consider a Range of Factors including the ability to Generate and Manage Cash Flow.

Change in Equity or Net Worth.

This Shows How Wealth Has accumulated or Declined Over the Year. It Is the Difference Between Equity at the Start of the Year and the End of the Year and Is Measured as the ₹ Change and the Change in Equity Percentage.

12.8 Preparing a Balance Sheet

a Balance Sheet Lists all assets and Liabilities at a Point in Time, to Calculate Net Worth. It Is Usually Prepared at the Start and again at the End of the Financial Year, So Changes in Net Worth Can Be Measured. to Create a Balance Sheet, You Will Need Lists or inventories of all the assets Used by the Business. You Will also Need a Plant and Machinery inventory, with a List of all the Equipment on Farm and the Estimated Market Value. This Will assist in Calculating the Cost of Depreciation. a List of all Debts Is also Useful, Showing the Type of Loan, the Term of the Loan and the Repayment Schedule. It Is Important to Highlight That This Balance Sheet for Business analysis Is Based on Market Value for assets. It Will Be Different to a Balance Sheet or Depreciation Schedule Provided by an accountant for Tax Purposes, as Several Key asset Values in a Tax analysis Generally Do Not Reflect Market Value.

12.9 Capital Gain

Capital Gain or Growth Is the increase in asset Value Over Time. Capital Gain Typically Happens Regardless of How the Business Is Performing. the Most Common Example Is Land Value and Water Rights. Livestock increase in Value as they age, Until the Point of Culling, and a Growing Herd Will See Capital Growth, Whereas a Stable Herd Will Typically Remain at Similar Values Over the Year. analysis of Farm Business Performance Typically Will Have Two approaches, one That Excludes Changes in Capital Value, Which Is the Normal approach in Benchmarking and Comparative analysis Measures and one That includes Changes to Capital

Values, Which Is Typically Completed at an individual Farm Business Level. the Wealth Report Does Not include Capital Gain in Calculating Return on total assets.

12.10 Depreciation

Most Other Farm assets Will Depreciate or Lose Value Over Time, as the More they are Used the Less Valuable they Become. Depreciation Is the Reduction in the Recorded Cost of a Fixed asset. in Business analysis This Loss of Value of assets Is Calculated and included as Depreciation in the Profit Report.

What to Leave Out Leave Out Non-Farm assets Such as Rental Properties, Vehicles, Shares, Superannuation, and any Non-Farm income from them, as these are Not Farm assets

12.11 Stock inventory Management Register:

1. inventory Items:

- List of all Items in Stock, including Feed, Medications, Equipment, and Other Supplies.

2. Description:

- Detailed Description of Each Item, including Specifications, Quantities, and Unit Costs.

3. Quantity:

- Recorded Quantity of Each Item in Stock, Updated Regularly Through inventory Checks.

4. Unit Cost:

- Cost Per Unit of Each Item, Used for Calculating total inventory Value.

5. total Value:

- total Value of Each inventory Item Calculated by Multiplying Quantity by Unit Cost.

6. Reordering Level:

- Minimum Quantity of Each Item Required to Maintain Stock Levels, Triggering Reorder When Reached.

7. Supplier information:

- Details of Suppliers for Each inventory Item, including Contact information and ordering Procedures.

8. Date of acquisition:

- Date When Each Item Was acquired or added to the inventory.

9. Usage Record:

- Record of Items Used or Consumed Over a Specific Period, Helping to Track Usage Patterns and forecast Future Needs.

10. Maintenance Record:

- Maintenance History for Equipment and Machinery, including Dates of Maintenance, Repairs, and Servicing.

11. Monitoring and adjustment:

- Regular Monitoring of inventory Levels to Identify Discrepancies or Shortages, with adjustments Made accordingly.

12. Security Measures:

- Measures to Safeguard inventory against theft, Damage, or Spoilage, including Secure Storage Facilities and access Controls.

13. Software or tools:

- Utilization of inventory Management Software or tools for Efficient Tracking, analysis, and Reporting of inventory Data.

Stock inventory Management Register											
Inventory Item	Description	Quantity	Unit Cost (Inr.)	Total Value (Inr)	Reorder Level	Supplier information	Date of acquisition	Usage Record	Maintenance Record	Security Measures	Software or tools
Feed	High-Quality Feed for Cattle	100 Bags	50	5000	20 Bags	Abc Feeds inc., Contact@Abcfeeds.Com, 123-456-7890	15-01-2023	-	-	Lockable Storage Room	Excel inventory Management tool
Medications	Antibiotics (Amoxicillin)	50 Bottles	10	500	10 Bottles	Xyz Pharmaceuticals, Sales@Xyzpharma.Com, 987-654-3210	20-02-2023	-	-	Restricted access Cabinet	Inventory Tracking Software
Equipment	Milking Machine	5 Units	2000	10000	2 Units	Milking Equipment Co., info@Milkingequip.Com, 555-555-5555	10-03-2023	-	Last Maintenance on 2023-04-05	Cctv Surveillance	Inventory Management System
Supplies	Rubber Gloves (Large)	200 Boxes	20	4000	50 Boxes	Safety Supplies Ltd., info@Safetysupplies.Com, 111-222-3333	01-04-2023	-	-	Locked Cabinets	Spreadsheets
	Cleaning Solution	50 Gallons	30	1500	20 Gallons	Cleaning Solutions inc., Sales@Cleansol.Com, 444-555-6666	15-05-2023	-	Last order on 2023-08-10	Security Cameras	Inventory Management Software
	Tags for Cattle Identification	1000 Pieces	10	1000	200 Pieces	Livestock Supplies Co., orders@Livestocksupsplies.Com, 777-888-9999	20-06-2023	-	-	Locked Drawers	Cloud-Based inventory System

13. ANNEXURES:

13.1 Tagging Method:

- Upon Birth, Each Calf Is Tagged with a Unique Identification Number That includes information about the Dam (Mother) and Sire (Father) Numbers.
- The Tag Number format Could Be a Combination of alphanumeric Characters, Where Each Part Represents Specific information:
- The Tag Starts with the abbreviation of the Farms Name.
- First Digits Represent the Dam Number.
- Middle Digits Represent the Sire Number.
- Last Digits Represent the Sequential Number of the Calf Born from That Dam-Sire Pairing.

13.2 Method of Tag Number:

Example format: Ff-Dd-Ss-Nnn

- i. Ff: abbreviation of the Farm Name (E.G., Kumaraguru Farm = Kf)
- ii. Dd: Dam Number (E.G., 001)
- iii. Ss: Sire Number (E.G., 002)
- iv. Nnn: Sequential Number of the Calf (E.G., 001 for the First Calf, 002 for the Second Calf, and So on)
- v. For Example, If Calf Number 3 Is Born from Dam Number 001 and Sire Number 002, the Tag Number Could Be "Kf-001-002-003".