



ISC2025 TOTAL MIXED RATION (TMR) TO ENHANCE DAIRY PRODUCTIVITY IN KOLHAPUR, MAHARASHTRA, INDIA

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Introduction:

Total Mixed Ration (TMR) is a scientifically formulated feeding strategy designed to optimize dairy production while maintaining animal health. Kolhapur, a prominent dairy hub in Maharashtra, India faces significant challenges related to seasonal green fodder scarcity, inconsistent nutrient intake, and escalating feed costs. Traditional feeding methods have contributed to suboptimal milk yields, lower fat and Solid-Not-Fat (SNF) percentages, and inefficient utilization of agricultural by-products. TMR includes feed ingredients such as silage, concentrate, dry fodder, etc. blended into a single, homogeneous mixture. It offers a promising solution by providing a balanced, consistent diet, which can enhance milk production, improve animal welfare, and increase economic returns for small and marginal farmers whose land holding capacity is less.

Feed Ingredients and Cost Analysis:

The TMR was composed of the following ingredients, with cost analysis detailed in the table below:

Table 1: TMR Composition and Cost Breakdown

Ingredient	% Inclusion	Total (kg)	Cost/kg (Rs / \$)	Total Cost (Rs / \$)
Concentrate	28%	1470	Rs 30.45 / \$ 0.3	Rs 44,761.5 / \$ 537.14
Dry fodder (wheat straw)	12%	630	Rs 12 / \$ 0.1	Rs 7,560 / \$ 90.72
Maize silage (30% DM)	59%	3097.5	Rs 7.8 / \$ 0.09	Rs 24,160.5 / \$ 289.93
Mineral mixture	0.4%	21	Rs 110 / \$ 1.3	Rs 2,310 / \$ 27.72
Bypass fat	0.4%	21	Rs 220 / \$ 2.6	Rs 4,620 / \$ 55.44
Buffer	0.2%	10.5	Rs 100 / \$ 1.2	Rs 1,050 / \$ 12.60
Salt	0.2%	10.5	Rs 35 / \$ 0.4	Rs 367.5 / \$ 4.41
Total	100%	5260.5	Rs 16.13 / \$ 0.19	Rs 84,829.5 / \$ 1,017.9

Table 2: Traditional Dairy Feed Composition and Cost analysis

Ingredient (with Category)	% Inclusion	Total (kg)	Cost/kg (Rs / \$)	Total Cost (Rs / \$)
Green Fodder – Napier Grass	62.32%	15	Rs 2.50 / \$ 0.03	Rs 37.50 / \$ 0.45
Dry Fodder – Sorghum / Maize husk	20.77%	5	Rs 9 / \$ 0.10	Rs 45 / \$ 0.50
Concentrate – Cattle Feed	16.62%	4	Rs 27.00 / \$ 0.38	Rs 108 / \$ 1.52
Mineral mixture	0.29%	0.07	Rs 100.00 / \$ 1.20	Rs 7.00 / \$ 0.084
Total	100%	24.07	Rs 8.21 / \$ 0.106	Rs 197.50 / \$ 2.55

TMR Preparation Process:

- All feed ingredients were precisely measured and mixed in a one-ton capacity mixer for uniform distribution.
- The mixed feed was baled into 50–60 kg packages, with a shelf life of 60– 90 days.
- Each bale was labelled with the manufacturing date and distributed to participating farmers for the trial.

Results:

The results of the trial showed significant improvements in milk quality across both HF crossbred cows and buffaloes.

Table 3: HF Crossbred Cows/Buffalo – Milk Yield performance, Quality and Price Comparison

HF crossbred Performance	Baseline Average for 7 Days	Week 1	Week 2	Week 3	Average (Week 1-3)	Change (%) (Baseline to average)	Milk Price Before (Rs) / (\$)	Milk Price After (Rs) / (\$)	Price % Change in total value
Milk yield (L/day)	10.36	10.43	9.44	10.21	10.02	-3.20%	Rs 29.8/L \$ 0.35/L	Rs 33.7/L \$ 0.39/L	9.38%
Fat (%)	3.88	4.17	4.12	4.2	4.16	7.30%	Rs 308.72	Rs 337.67	
SNF (%)	8.2	8.36	8.54	8.3	8.4	2.44%	\$ 3.58	\$ 3.92	

Buffalo Performance	Baseline Average for 7 Days	Week 1	Week 2	Week 3	Average (Week 1-3)	Change (%) (Baseline to average)	Milk Price Before (Rs) / (\$)	Milk Price After (Rs) / (\$)	Price % Change in total value
Milk yield (L/day)	6.72	7.1	7.79	7.73	7.54	12.15%	Rs 54.5/L \$ 0.63/L	Rs 62/L \$ 0.72/L	27.64%
Fat (%)	6.5	6.9	7	7.35	7.08	8.97%	Rs 366.24	Rs 467.48	
SNF (%)	8.4	8.93	9.1	9.25	9.09	8.23%	\$ 4.25	\$ 5.43	

Discussion:

The trial results demonstrated several key benefits of TMR feeding:

Improved Milk Yield and Quality: Buffaloes exhibited a 12.2% increase in milk yield, with higher fat (8.97%) and SNF (8.23%) percentages, enhancing product value. HF crossbred cows showed an increase in fat (7.22%) and SNF (2.44%), but a slight decline in milk yield (-3.29%), likely due to dietary transition stress, adaptation period, or high baseline yield.

Conclusions:

The pilot TMR initiative in Kolhapur successfully demonstrated the potential of scientifically balanced feeding in improving dairy productivity and profitability, particularly for small and marginal farmers. Buffaloes responded with notable gains in milk yield and quality, translating to a 27.6% increase in milk value. While HF cows showed modest milk quality improvements, a brief yield dip highlighted the need for longer adaptation. Overall, TMR’s ability to deliver higher nutrient density with reduced feed volume makes it a scalable, sustainable solution. Widespread adoption across Maharashtra can help transform dairy farming into a more efficient and income-generating enterprise.

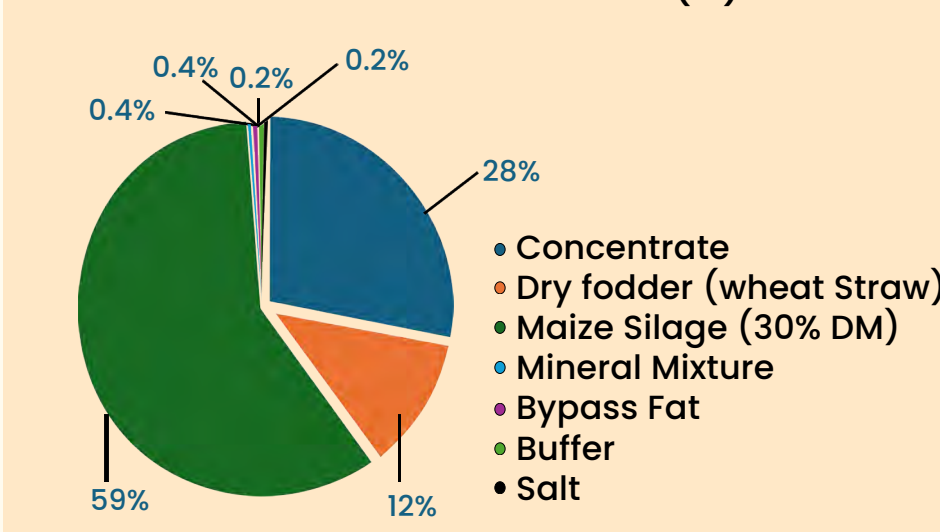
Materials and methods:

The objective of this project was to do a pilot in TMR facility at Warananagar, Kolhapur, and assess its impact on milk yield, milk quality, and the economic viability for farmers. A controlled 28 day trial involving Holstein Friesian (HF) crossbred cows and Murrah Buffaloes was conducted to evaluate these parameters

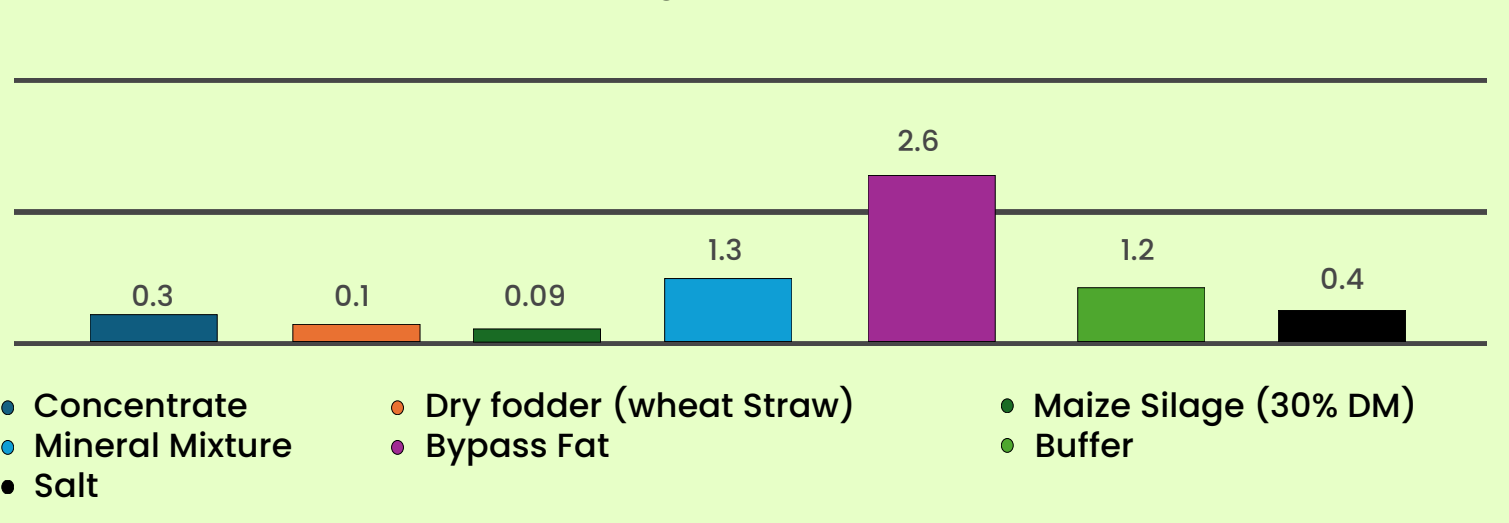
TMR Plant Setup:

- Location: Animal Holding Station, Warananagar, Kolhapur, India
- Infrastructure and machinery:
 - TMR mixer, Silage Baler, tractor with trolley etc
 - Office space for staff members
 - Animal shed
 - Two acres allocated for material storage
 - Existing covered structure utilized for plant operations

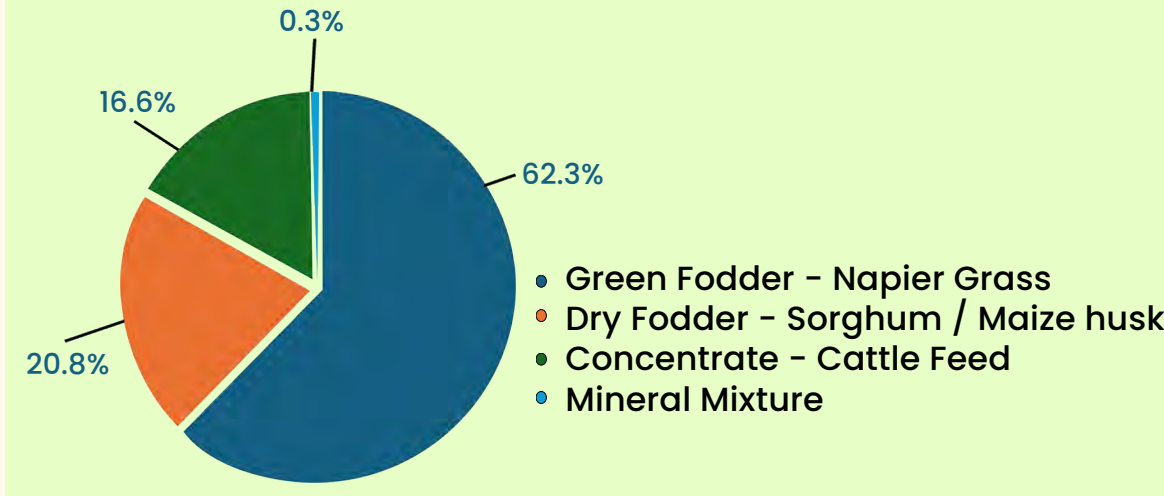
TMR Constituents and inclusion (%)



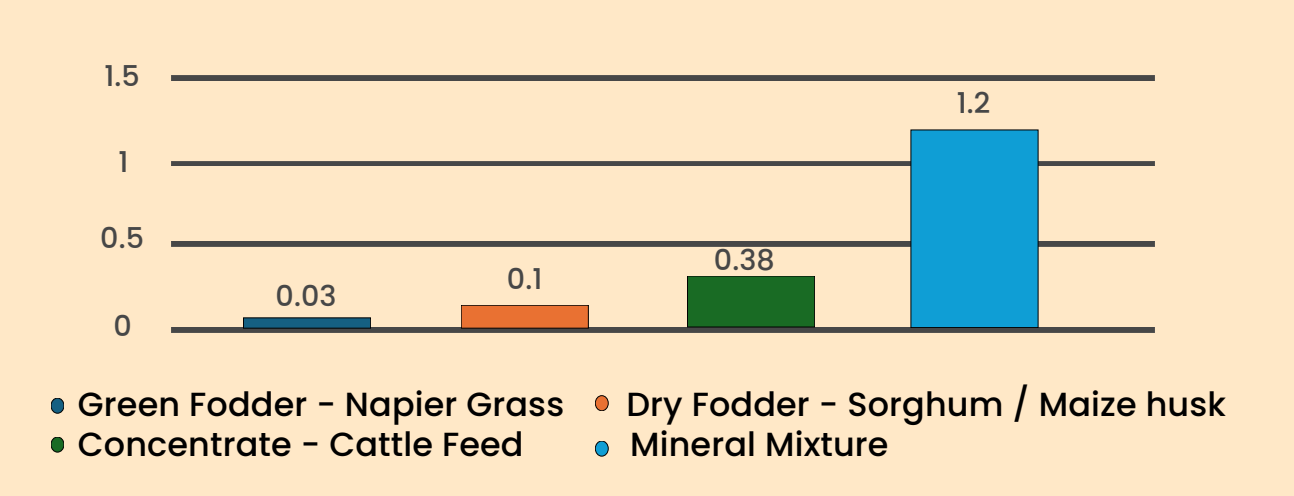
Cost of Constituents of TMR per Kg (in Dollars)



Traditional Dairy Feed Constituents and inclusion (%)



Cost of Constituents of Traditional Dairy Feed per kg (in dollars)



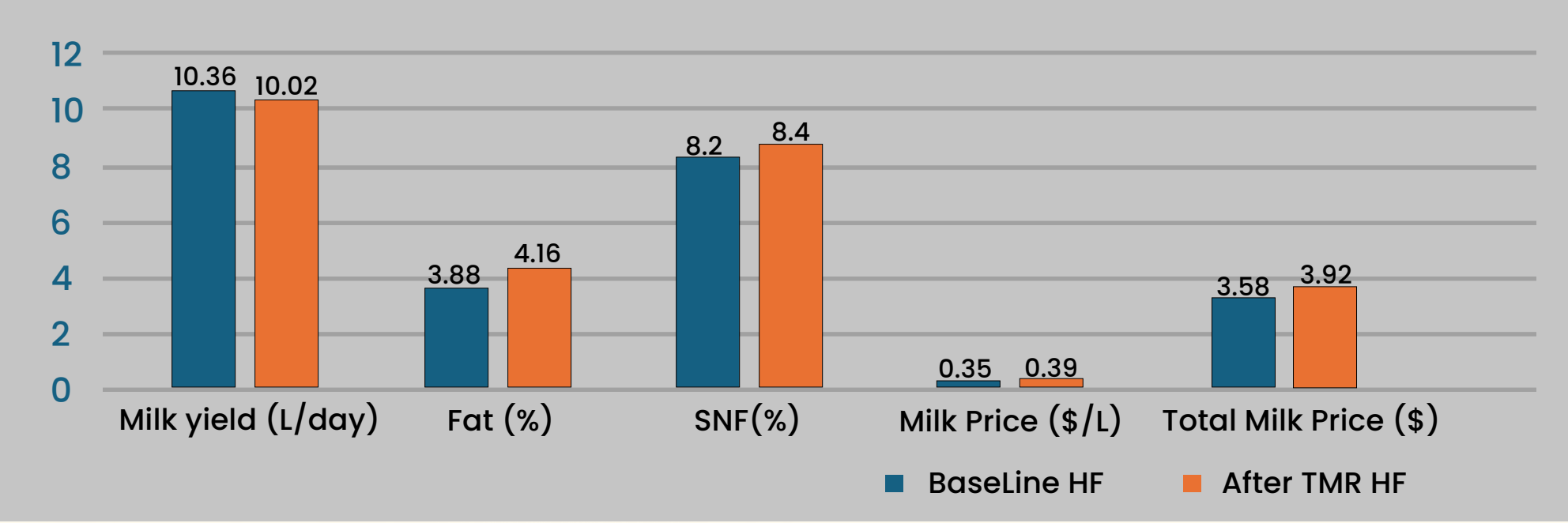
Trial Design:

Animals: 5 HF crossbred cows, 2 Buffalo with a combined average baseline milk yield of 8.54 litres/day.

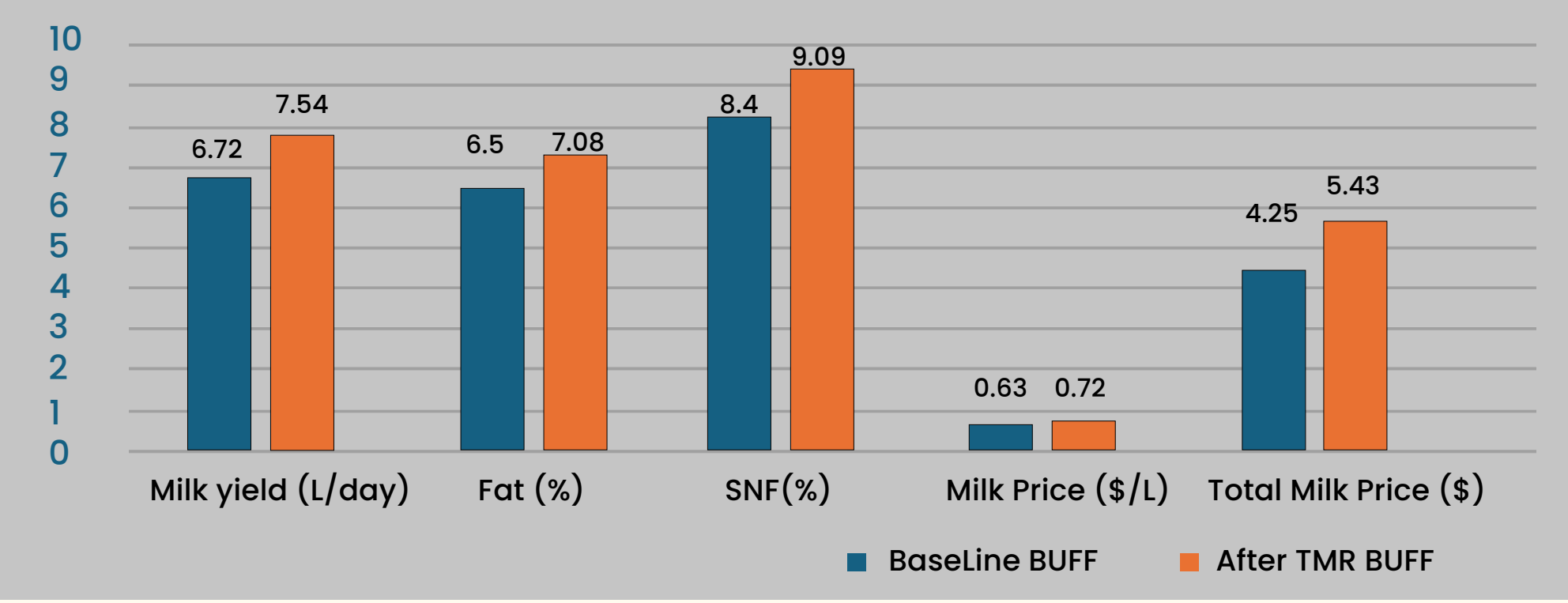
Duration: 28 days, with an initial acclimatization period of 7 days.

Data Monitoring: Daily measurements of milk yield, fat percentage, SNF content, and feed intake were recorded.

HF Crossbred Cows – Milk Yield performance, Quality and Price Comparison



Buffalo – Milk Yield performance, Quality and Price Comparison



Economic Benefits: While the traditional feed cost was lower at ₹8.21 / \$0.106 per Kg, it had to be fed in significantly higher quantities to meet the animals’ nutritional requirements. In contrast, TMR at ₹16.13/kg (\$0.19) provided a dense, balanced diet requiring nearly half the quantity for the same nutrient delivery. This not only reduced bulk handling and wastage but also improved feed efficiency. The higher milk prices from better fat and SNF levels, especially in buffaloes (27.6% value increase), made TMR more profitable despite its higher per kg cost.