Performance Recording in Bovines under the small holders dairy production system in India - Challenges & suitable interventions

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Dairying in India – Unique features
Dairying in India is a livelihood, a vital economic activity for the upliftment of the rural milk producers.

- It contributed about 66% value of the output of the livestock sector.
- Milk remains the single largest agricultural commodity with a value of US$125.42 billion.
- India has highest number of bovines in the world - 302 million of which 190 millions are cattle (13% of world cattle) and 110 million buffaloes (54% of buffalo population).
- With 53 well defined breeds of cattle and 20 breeds of buffaloes – blessed with a large repository of bovine population with rich biodiversity.
- These breeds survive harsh climatic conditions and resistant to many diseases.
- Dairying is practiced along with Agriculture – as mixed production system

- Livestock are fed with the by-products of the crop – providing an avenue for effective utilization of crop residues

- Dairying has emerged as a perfect model of the circular economy
More than 70% of the dairy farmers keep 1-2 animals in their herd.

- Largest producer of milk with **221.06 million tonnes (2021-22)**
Milk production in India involves millions of small milk producers, who are scattered across thousand of villages.

“Production by masses not the mass production” - an unique characteristics of Indian dairying.
Mode of Transportation of Milk from Village to Dairy Plant
Challenges in implementing field performance recording system

- Smaller herd size
- Scattered villages
- Lack of awareness among the farmer about the importance of performance recording
Challenges in implementing field performance recording system

- Animal Identification
- Involvement of multiple agencies
- Logistics issues in collecting milk samples for component analysis
- Lack of facilities for milk component analysis
- Challenging local environment
- Free trade and transport of animals
### Field Performance Recording ...Journey so far

- **Dairy Herd Improvement Programme Actions – DIPA**: During late 80’s NDDB initiated comprehensive programmes of milk recording and genetic evaluation of animals in selected districts of Gujarat, Karnataka and Tamil Nadu state.

- **Since 2008:**

<table>
<thead>
<tr>
<th>Period</th>
<th>No. of Projects</th>
<th>Breed covered</th>
<th>Name of Breeds</th>
<th>No. of animals milk recorded</th>
<th>No. of milk records (million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008-2012</td>
<td>9</td>
<td>7</td>
<td>Cattle: HF, HF cross, Jersey cross, Rathi, Kankrej Buffalo: Murrah, Mehsana</td>
<td>28133</td>
<td>0.22</td>
</tr>
<tr>
<td>(Pre NDP)</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>(NDP-I)</td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>2019 Onwards</td>
<td>23</td>
<td>16</td>
<td>Cattle: Gir, Sahiwal, Jersey, HF cross, Jersey cross, Rathi, Kankrej, Tharparkar, Hariana, Gaolao Buffalo: Murrah, Mehsana, Nili Ravi, Pandharpuri, Jaffarabadi, Banni</td>
<td>265300</td>
<td>2.54</td>
</tr>
<tr>
<td>(RGM)</td>
<td></td>
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</tr>
</tbody>
</table>
# Traits Measured

<table>
<thead>
<tr>
<th>Production Traits</th>
<th>Reproduction Traits</th>
<th>Type Traits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test day yield</td>
<td>Age at First AI</td>
<td>Stature</td>
</tr>
<tr>
<td>305 day yield</td>
<td>Age at First Calving</td>
<td>Heart Girth</td>
</tr>
<tr>
<td>Test day fat %</td>
<td>No. of AIs per conception – heifers and cows</td>
<td>Body Length</td>
</tr>
<tr>
<td>305 day fat %</td>
<td>Service period for cows</td>
<td>Central Ligament</td>
</tr>
<tr>
<td>Test day fat yield</td>
<td>Bull conception rate</td>
<td>Body Depth</td>
</tr>
<tr>
<td>305 day fat %</td>
<td>Inter-calving period</td>
<td>Angularity</td>
</tr>
<tr>
<td>Protein, Lactose and SNF %</td>
<td>Calving Ease</td>
<td>Rump Angle</td>
</tr>
<tr>
<td>Protein test day yield</td>
<td></td>
<td>Rump Width</td>
</tr>
<tr>
<td>Protein 305 day yield</td>
<td></td>
<td>Rear Teat Placement</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rear Leg Set</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rear Udder Width</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rear Leg Rear View</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Teat Thickness</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Foot Angle</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Body Condition Score</td>
</tr>
</tbody>
</table>
Interventions
A. Institutional arrangements for supervision of performance recording

Project Management Committee
(for general superintendence, direction, control & management of project affairs & activities)

Project Implementation Cell
- Surprise check of milk records (10%)
- Validation of milk records (10%)
- AI follow-up
- Type classification
- Growth measurement

3 members Evaluation Committee (Annual Evaluation)

Monitoring Officer from NDDB Quarterly visit

Project Coordinator

Area Coordinator (1-4)

Supervisor (3-15)

Milk Recorder (30-120)

MR cover 1-2 villages; No. of animals recorded/month/recorder: 50-90;
Incentives to MR for milk recording $15/animal for 10 TDR; Incentives to farmer: $6-$12/animal (on completion of 10 TDMR)
B. Animal Identification

- A Unique 12 Digit Barcoded Ear Tag to identify, register and track each Animal
Biometric identification through muzzle map
C. Online Data recording through Information Network for Animal Productivity & Health (INAPH)
Hardware and different platforms

Clients

Smartphone

Tablet

Desktop

Netbook/Laptop

Servers

Internet
Data Flow through - INAPH

In the diagram:
- **Central Server** contains the Web & DB Server.
- **Organisation / EIA/Service Provider** communicates via http to the Central Server.
- **Laboratory (Feed/Disease/Milk)** sends data via GPRS / GSM / CDMA using TruSync.
- **Manager/Admin** and **Field Force (AIT/MR/LRP/Vet)** send data via SMS Message.
- **Farmer** interacts with the system through a mobile device.

The diagram illustrates the flow of data through INAPH, involving various stakeholders and communication methods.
D. Milk recording through Smart Weighing Scale
E. Measuring Milk Components

65 no. of Milk testing Labs equipped with milk component analyzers have been established for milk component analysis (Fat, Protein, SNF, Lactose) at project level

Recording:
Monthly milk sample on the day of milk recording
Milk sample testing at labs at project level

Traits:

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<tr>
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<tr>
<td>Protein test day yield</td>
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<tr>
<td>Protein 305 day yield</td>
</tr>
</tbody>
</table>
Milk-o-bike
F.Type Traits measuring devices
G. Dairy Surveyor App – for monitoring Field activities
Outcome
1. Creation of a huge volume of national database

<table>
<thead>
<tr>
<th>Species</th>
<th>Milk Records (million)</th>
<th>Fat Records (million)</th>
<th>Protein Records (million)</th>
<th>Lactose Records (million)</th>
<th>SNF Records (million)</th>
<th>Animal Typed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cattle</td>
<td>3.41</td>
<td>2.17</td>
<td>1.91</td>
<td>1.62</td>
<td>2.25</td>
<td>17388</td>
</tr>
<tr>
<td>Buffalo</td>
<td>2.64</td>
<td>1.50</td>
<td>1.19</td>
<td>0.97</td>
<td>1.28</td>
<td>8895</td>
</tr>
<tr>
<td>Total</td>
<td>6.06</td>
<td>3.68</td>
<td>3.10</td>
<td>2.60</td>
<td>3.53</td>
<td>26283</td>
</tr>
</tbody>
</table>
2. Implementation of Genomic selection using recorded female reference population

- Development of customized medium density genotyping chip – **INDUSCHIP** (for cattle) and **BUFFCHIP** (for buffaloes)
- Creation of reference population major dairy breeds of cattle and buffaloes
- Selection of young bulls on the basis of **Genomic Breeding values (GBV)**

<table>
<thead>
<tr>
<th>Category</th>
<th>No. of Samples in repository</th>
<th>No. of Samples genotyped</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cattle</td>
<td>82609</td>
<td>31207</td>
</tr>
<tr>
<td>Buffalo</td>
<td>50326</td>
<td>16447</td>
</tr>
<tr>
<td>Total</td>
<td>132935</td>
<td>47654</td>
</tr>
</tbody>
</table>
3. Identification of champion cattle & buffaloes of various breeds in the breeding tracts

4. Capacity Building: Developed a pool of trained professionals to manage complex Progeny Testing programs, proficiency in handling & analysis of genotyping data

5. Higher market value of the performance recorded animals motivated farmers and ensured their active participation

6. Development of a successful model for field performance recording under the smallholder production system in India

7. Govt. of India approved “National Milk Recording Programme” with an aim to record 1 million animals engaging ~75000 trained milk recorders
Future Aim

➢ Inclusion of various new traits for performance recording
  - Mastitis incidence
  - General Immune Response measurement
  - Methane emission measurement
  - Heat Stress
  - Temperament
  - Milkability

➢ Index based selection of bulls combining economically important traits

➢ Integrating genomic selection with IVF to accelerate genetic progress

➢ Automated body type classification using computer vision
Thank You