Disease Prediction, Early Warning Systems and Herd Health Management

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Continued from inaugural session

- Continuation to my comments at the time of inaugural session:
 - India being a non-culling development model, we need cows that have longevity in production – Focus on selection – feet / disease resistance / mid-level milk production
 - Sexed semen- This technology is used in a restricted manner
 - In the USA only in 4% of the inseminations are with Sexed Semen, restricted in sexually healthy virgin heifers, that too limited to two inseminations.
 - In Brazil, 85% of cows are not inseminated but being of beef category these are served naturally by bulls.
 - In 15% milking cows, sexed semen is used as timed insemination after using synchronizing hormones.
 - In warm climates, the likelihood of male births could be as high as 20 %. In India, the climate is warm in most regions

	Male: Female Cattle 2019 Census									
	Overall	Overall Indigeno								
		us	ed							
India	30:100	44:100	7:100							
Gujarat	23:100	42:100	4:100							
Uttar	15:100	37:100	7:100							
Pradesh										
Maharash	55:100	103:100	4:100							
tra										

Problem of Cattle on Street and Gaushala

- Stray Cattle population 3.45 lakhs, Maharashtra 12.76 lakhs, U. P. 20.59 lakhs, 3.45
- 95% of the stray are female
- I collected data from 15 Gaushalas in various states
- 18,447 cows –Bulls / bullocks 275
- Example- Gujarat 18 lakh breeding cows, all covered with sexed semen
- In 2024- the female calves would be (80% cows complete 3 breeding cycles) – 43 lakhs new calves + 15 lakhs survival = 58 lakhs + 43 lakhs = 110 lakhs – With 18 lakhs you have 3.45 stray cows-
- Why buffaloes are not straying?

State	Stray Cattle Lakhs
Maharashtra	12.76
Gujarat	3.45
Rajasthan	12.75
U. P.	20.59
M.P.	10.02

Smart Dairy Farming

- The topic of the course is Smart dairy farming: Boosting Productivity Through Innovations:
- I will deal with this topic at two levels:
 - Farm-level (For small-hold I will consider a village as a farm herd)
 - Macro-level- Cooperative, district, state, etc.
- At the farm level Herd Health Management will encompass
 - Disease prediction Disease occurrence is around 5% but health occurrence is expected in 100%, so I will rather emphasize on 'Health Prediction' and any aberration as 'Disease'

What Is Smartness?

- Aptly not chose the topic 'Intelligent dairy farming' Why-Difference between smart and intelligent
- Smart The quality of being intelligent, or able to think quickly, differently or intelligently in difficult situations
- Story of a smart boss and an intelligent colleague
- Both sat for an online IQ test of 30 minutes.
- The boss chose the answers randomly in 5 minutes and submitted to receive terrible result- but he could know what were the right answers. He downloaded another answer sheet and answered all answers correctly-Result Genius
- The intelligent- Sweated, honestly struggled to answer and got 20 marks less than the smart boss-
- So do be smart and teach your farmers to do smart dairying

How to smart people take decisions?

- Determine the problem- My take will be Predict the problem- Need early warning systems
- Establish the criteria Analyse associated factors to crystallize cause
- **Consider alternatives** What are the solutions?
- Identify the choice Choice criteria- Cost : benefit ratio / animal welfare
- **Develop plan of action** How the decision will be implemented?
- Evaluate the solution Impact assessment

Herd Health Management

- Planned animal-health and production-management program that uses a combination of regularly scheduled veterinary activities and good herd management designed to optimize animal health and productivity (Blood, 1979.)
- Certain diseases and production constraints can be anticipated on the basis of accumulated experiences.
- Designed to minimize potential adverse effects of these predictable constraints and to protect against unexpected ones.
- Record Keeping: For prediction the core requirement is record keeping- Data – Predicts actions to be taken, subclinical problems, associated factors, impact of the interventions, etc.

Examples of how data will help

- In a dairy cooperative- it is reported that number of pregnancies have gone down. Offer a solution-
- Is it only perception or real-
 - Month-wise number of pregnancies Vs number of inseminations What is the trend? Any point when trend changed?- If so, look for change
 - Is it general or localized need data on all para-vets- some doing good, few bad? Who are they?
 - Is it related to sires? Sire-wise data on conception
 - Is it related to heat detection efficiency? data on number of negative at PD
- If there was an early warning system- It would have given you early alarm

How Data will help in the decision-making

- A farm reports continuous drop in milk production-
- Data on daily production when did it start? Mean <u>+</u> S. E. Common Source of Individual
- Is it due to cows in late lactation (generate curve of fresher, peak, mid and late lactations)
- Fresh cows post-peak yield- Ketosis, energy related
- Abnormal milk constituents- high fat, low protein, Protein: Fat ratio
- More animals pregnant- Late lactation effect ...
- If you had a early-warning system- prediction

Innovations- Record Keeping for Small-holders

- Small-hold farmers are resource poor, 2-3 animals per farmer
- Who will update data?
- Data should be updated in real-time from animal side
- Data should be processed in real time and communicated to all the stakeholders in real time
- Inclusive for all the stakeholders farmer, para-vet, vet, manager, milk collection centre, milk processing companies, quality control laboratories
- Al-enabled forecasting
- Machine-linked- IoT, diagnostic gadgets, ...

Tag-N-Trace- Novel Identification Devices

- Current requirement is Traceability
- Should be able to access animal's data any where – any time
 - Check post
 - Transport
 - Abattoir
- Data funding not possible
- Imprint of the visit time- tracking of services
- Scan the code with App on cell phone to register and data update

Service Data Update Stray Cattle Cattle In Transport Cattle in conflict







Linear / QR code and RFID Scanner Cum Data Management App

- Register animal
- Data Update AI / PD / Vaccination / Treatment Data update from animal side
- Daily Action List Heat, PD check, calving, vaccination, treatment, milk record, etc.
- Alarm List Under-performing animals- Longer calving to conception interval, Repeat breeders, etc.
- Non-pouring / Defaulter farmers:





Herdman-Server –Laptop Software



DASHBOARD TO MONITOR <u>SERVICES</u> AND DATA TRAFFIC

• Registration:: 566 • Milk:: 369 • A.I:: 977 • PD:: 350 • Calving:: 54 • Treatment:: 170

15 -

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Animals Registered by Paravet

Traceability of Services- for paying charges

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H Other bookmarks

Generating Analytical Maps

- Areas animals registered
- Disease prevalence in areas
- Vaccination Vs Diseases
- Drug Use Spread
- Open Animals
- Pregnant Animals
- Periodic maps
- Collection centres milk collected / milk forecast



Bos indicus digitus / Bos taurus digitus

- The western Animal Health IoT solutions are plagued by antiquated communication protocols and use local desktop for computing.
- Expensive and require elaborate infrastructure
- Narrowband Internet of Things (NB-IoT) is a Low Power Wide Area Network radiotechnology standard developed by 3GPP to enable a wide range of cellular devices and services.
- NB-IoT focuses specifically on indoor coverage, low cost, long battery life, and high connection density.
- NB-IoT uses a subset of the LTE standard, but limits the bandwidth to a single narrow-band of 200kHz. It uses OFDM modulation for downlink communication and SC-FDMA for uplink communications.



Novel IoT for Auto-data Update

- Oestrus
- Abortion
- Calving- process
- Sickness
- Time spent on rumination
- Time spent on feeding
- Time spent on resting



Figure 2: Activity index plotted against time series & statistical change point test applied. Onset of estrous is bubbled on the basis of activity peak.

Wearable to Detect Body Temperature

- We are developing a wearable device, applied under the tail
- The one available in the market are to be tagged to the ear
- It reads data every 15 minutes Junk data which is of no use
- Ours removable- takes data only when threshold is breached
- Under the tail is a better place-protected from ambience, near-to-body temperature
- We don't use flash light-
- Also to be used in dogs and cats





Smart Rumen Bolus

- To be fed orally
- Detects animal movements
- Rumen activity
- Rumen temperature
- Rumen pH



Vocalization, Cough and Brain Reading

- Scientists are out to decode animal language
- Alexandra Green from Institute of Life Sciences, Sydney
- Their emotions and need can be recognized
- Calf- when they need milk, water, scared, sick





Bos indicus digitus / B. taurus digitus



Smart Stethoscope and Tele-veterinary- Way to Involve Vets on Larger Scale

• Since number of vets are less and cant reach every spot where cases are reported ICT will wipe out this distance - <u>Video</u>





Cell Phone As a Diagnostic Microscope

- We are adopting this technology by Attaching an external lens adapter to cell phone camera
- The adopter has insert provision for glass slide
- In simpler cases the image on screen can be processed and sent to the Veterinarian
- Sperm-motility, abnormal sperm
- Fractal mucous / saliva Pattern in oestrus and pregnancy
- Ova/ cyst in feces



Encrypted QR codes and Scanner Apps





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Some example of how data saves money and increases decision efficiency

- Some Examples of Smart Decisions based on Herdman Data
- Out of 2,80,000 AI done- Data was analysed for sire efficiency
 - Fertility to up to 2 AI
 - % Female calf born
- The bulls were ranked- > 70% pregnancy rates- Rank 1, 60-69 rank-2 and 59-50 rank 3.
- Out of 110 sires used, only 12 sires qualified ranking
- The rank sires were used in only 23 % AI
- Changed sires below 40%, there was improvement in conception by 20%, 65,000 AI were saved, AI visits were saved

Prediction, Early Warning

- Mastitis- 80% cases in DIM > 100 days, Contagious
- Treatment 75% cases unrelated treatment was administered
- In 99% cases no outcome was recorded by the Vet.
- Predict management events heat, PD check due, Calving due, drying-off due, vaccination due
- Early warning
 - No heat 60 days post calving, not bred 90 days, not pregnant 110 days
 - Late to peak, drop in peak,
 - Low sire fertility / high sire fertility
 - High SCC
 - High cost of milk production
 - Similar in poultry

