

Title: - Evolving from Buyers to Producers: Liquid Nitrogen Plant

Category: - Animal Husbandry- Infrastructure development to increase shelf life of germplasm.

Challenges: -

With the advent of semen collection and extenders (dilutors) Artificial Insemination (AI) replaced the institutional crossbreeding centres which used bulls for breeding cows and buffaloes. The central semen stations took their place but in lesser numbers. They collected semen of High Genetic Merit (HGM) bulls, diluted that to make multiple doses and supplied them in cold chain to the AI centres. This semen had a shorter shelf-life, so had to be used in a couple of days. This technique reduced the cost of breeding, both by reducing the number of bulls and the manpower required to maintain them.

However, the real revolution came with the use of cryopreservation technology using Liquid Nitrogen. The semen doses were diluted and filled in straws, they were gradually cooled down to the temperature of liquid nitrogen which is -196°C . This actually increased the life of frozen semen from couple of days to 10-15 years. Easy transportation of thousand/ lacs of straws in cryo-containers had



Cryocontainer with LN₂ and frozen semen straws

brought A.I. to the farmer's doorstep and led to an increased coverage of A.I. This helped in expansion of AI to far reaches of the State and use of semen of the champion bulls even after they are gone.

This advancement in technology made supply and storage of LN₂ a necessity as it gets evaporated quickly even when stored in insulated cryocans. The central semen station, all semen banks and AI centres needed a regular and unabated supply of LN₂. Some fertilizer plants and medical oxygen production plants were the only source of LN₂ where it was produced as a by-product. The supplies were erratic and when available, were at inconvenient locations. This in turn led to loss of frozen semen doses.

Key results/insight/interesting fact: -

There were 2369 AI centres run by the department and 633 run by Madhya Pradesh Co-operative Milk Federation (MPCDF), two major players in the State performing AI. During the year 2011-12, the department of animal husbandry in Madhya Pradesh, purchased 5.22 lakh liters of LN₂ at a cost of Rs. 162.25 lakhs, from various suppliers/firms, from within and outside the State. Hence, a proposal under the Rashtriya Krishi Vikas Yojna (RKVY) was submitted to the Central Government to establish 3 LN₂ plants in the state at- Gwalior, Jabalpur and Bhopal. The plants could produce

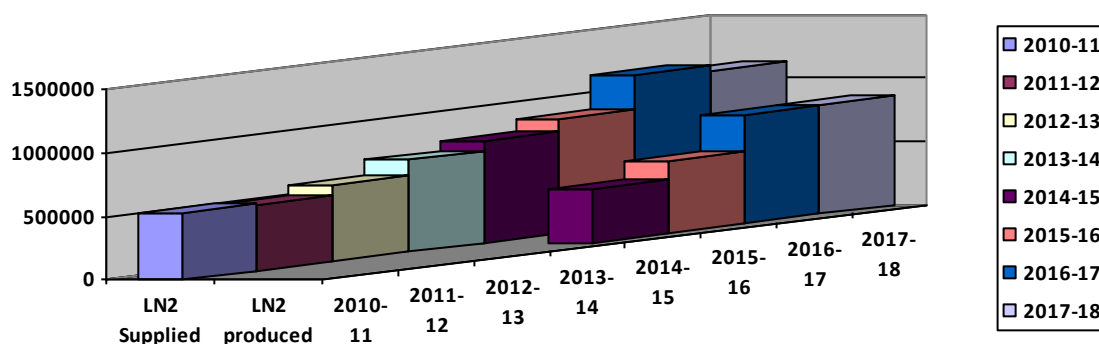


Fully automatic LN₂ plant

21-33 liters of LN₂ per hour i.e, 1.76 lakh liters in a year. The power consumption was 44 kW leading to cost of production to be Rs. 11.36 per liter at a capital investment of Rs. 86.2 lakh.

Impact: -

Once the liquid nitrogen plants came into production the dependence on other sources got curtailed. Evaporation losses of liquid nitrogen, during transportation and filling of containers, were also reduced to 25-30% from the previous 35-45%. In the year 2017-18 the LN₂ plant at Bhopal produced about 1.54 lakh liter of LN₂ and purchased 2.36 lakh liters.



Increased and assured availability of LN₂ resulted in increased AIs and proliferation of AI facility. The AI centres increased from 2369 in 2011-12 to

2950 in 2016-17 plus 1296 MAITRYs who performed 26.9 lakh AIs as compared to 11.41 lakhs in the corresponding period. This amounts to coverage of 30% of the breedable bovine population of the state as compared to 12.7% previously. Madhya Pradesh now stands 4th in milk production in the country as compared to 7th before the plants were installed.



A.I. worker performing A.I. at the door-step of farmer.

Lessons Learned: -

Self-dependence is the need of the day, especially when the item is a basic necessity. Establishment of LN₂ production plant at strategic locations is the need of the day. For easy supply of LN₂ to all the stake holders, the supply area should be divided into zones and these plants are to be placed at the centre of each such zone. Supply routes should be so designed to make the distribution easy and economical.

LN₂ plants at Gwalior catered to demands of northern region, Bhopal to the Central and Western whereas Jabalpur supplied to Eastern and Southern region of the State. The requirement of LN₂ for the Central Semen Station (CSS) at Bhopal for production and long term preservation of semen doses itself required large quantity of LN₂ and there were high demand in eastern zone also, to be supplied from the plant at Bhopal. Hence, another proposal was submitted to establish LN₂ plant at Indore. This further reduced the dependence on external sources for the supply of LN₂. However, to become self-dependent in LN₂ supply, the production needs to be raised from the present level to its double. This requires installation of plants producing double the quantity of what the existing plants are doing.

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