



Farmer-led innovations: Best practices and lessons learnt in livestock rearing

RAKESH KUMAR¹, PREMLATA SINGH², VINAYAK R NIKAM³ and J P SHARMA⁴

ICAR-Indian Agricultural Research Institute, New Delhi 110 012 India

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ABSTRACT

The livestock sector contributes 4.11% in overall GDP, however, its full potential has not been utilized, necessitating need of innovations and the use of best practices for sustainable and profitable production. Farmers are a rich source of indigenous knowledge and they innovate, experiment and adapt continuously. Documentation of these success stories may serve as a lightning conductor for other farmers. The study was carried out with 35 progressive farmers from 10 agro-climatic regions of Karnataka. The study found that stall feeding for sheep, silage preparation and storage in bunkers, low cost dairy shed and locally made milking machine were innovations made by farmers. New technology adopted by the farmers included improved crossbreeds of sheep, emu farming, high tech dairy unit and fast growing breeds of pig. Farmers frequently used literature and KVK personnel as a source of information. Development of marketing linkages, direct marketing and contract farming were important aspects in post production operations. Farmers used some of the best practices like integrated farming system; clean and hygienic methods of milking, regular vaccinations, daily chart of feed, silage and bunker storage, rotation period, use of high jet water spray for washing of animal etc. Study concluded that qualities and traits like ability to select and integrate enterprise wisely; knowing and judging market demand correctly; developing market linkages; constant seeking of information and practical intelligence to use locally available resources were the key to success of dairy farmers. Dairy extension should play a pivotal role in imparting training to farmers about these aspects and spreading the success of these innovative farmers through literature in other parts of the country for its replication on large scale.

Key words: Best practices, Dairy, Innovations, Lessons learnt, Livestock rearing

The animal husbandry and livestock sectors are crucial for the development of rural economy as well as the small and marginal farmers. It acts as supplement to agriculture, horticulture, fishery and agro based enterprises (Birthal *et al.* 2012). It helps in increasing income of the farmers (Shaphiya 2014, Birthal *et al.* 2012) and also serves as insurance against natural calamities. Moreover, it is the medium to ensure participation of rural women in economic activities, decision making which results in women empowerment (Rathod *et al.* 2011). In agriculture, fishing, forestry sector, the livestock sector alone contributes 25.6% of value of output at current price. In overall GDP, it contributes 4.11% at current prices during 2012–13 (Livestock census 2012).

However, for sustainable dairy production, continuous innovations and adoption of new technology is essential. Here the farmers' role become crucial. Out of creativity, necessity, and opportunity, the informal experimentations and innovations in dairying have taken place. Farmers are

a rich source of indigenous knowledge and practice and they experiment, adopt and innovate continuously (Chambers 1986, Rhoades 1987, Gupta 1996). Need of the hour is that they recognize these farmers' innovations, document and give wider publicity so that these innovations can be diffused to other parts of the country to emulate them for profitable, sustainable livestock rearing and dairying.

Traditionally, farmers are kept at the end of research-extension-farmers linkages and considered as passive recipients of knowledge (Roling 1988). With the increased realization that farmers have valuable knowledge, wisdom and experience and as the end users of the technology, they should participate in all stages of research; gradual shift from linear transfer of technology model towards innovation system approaches took place (Chambers 1986, Roling 1988). Innovations of dairy and livestock farmers need to be documented and analysed to learn lessons from their experiences and best practices. Considering this in mind, research was conducted to study successful dairy farmers from Karnataka state of India with objectives to document innovations and best practices in dairy farming, to study the economic viability of the enterprises and delineate lessons learnt from innovative dairy and livestock rearing practices.

Present address: ¹Ph.D Scholar (rakesh.ext@gmail.com), ²Professor and Head (premlatasingh@yahoo.com), ⁴Joint Director (jd_extn@iari.res.in), Division of Agricultural Extension, ICAR-Indian Agricultural Research Institute, New Delhi. ³Scientist (vr.nikam@icar.gov.in), ICAR-Central Soil Salinity Research Institute, RRS Bharuch, Gujarat.

MATERIALS AND METHODS

Study area: The study was conducted in 10 agro-climatic zones of Karnataka state of India, which was divided into 4 strata having similar conditions of rainfall, soil conditions and cropping pattern. Karnataka, situated approximately between the latitudes 11.5° and 18.5° N and the longitudes 74° and 78.5° E, is having a diverse climate and 71% of the total work force is engaged in agriculture. States shares 4.98% cattle, 3.19% buffalo, 14.73% sheep, 3.55% goat, 2.96% pig, 7.33% poultry population of the country (Livestock census 2012).

Study approach and sampling methods: A scientific and systematic procedure was followed in study. A triangulation approach which uses a combination of both qualitative and quantitative methods was used. From 4 strata, unique 35 successful and innovative farmers were selected. For this, database of awardees and achiever farmers from the State Department of Agriculture, Directorate of Extension of the UAS, Bengaluru; Directorate of Extension of UAS, Dharwad; NGOs and other private agencies were pooled together and most unique innovative farmers were selected purposively. For proper representation of farmers and to ensure reliability in the data, a systematic and ethical protocol was followed (Singh *et al.* 2011).

Method of data collection: Data were collected in 2012–

13 using a well structured interview schedule containing both close end and open end questions. This was pilot tested on non-sampling populations in order to remove ambiguity in response. Information related to socio-economic condition, innovations and best practices elicited by asking questions to farmers with the help of personal interview. Personal and participant observation method of data collection was also used to understand the innovative and best practices adopted by the farmers. Information provided by the farmers was validated with KVK personnel working in the area and other farmers from the village.

Data analysis: Since most of the data were of qualitative nature, to ensure objectivity in research, a general analytical strategy (Yin 1994) was followed to look at different perspectives, *viz.* new innovations, new technology adopted, post production operation has been given due importance etc. These farmers were grouped into different categories considering the major innovation/reinvention they have made/adopted in their dairy farming and livestock rearing, which was labeled as the Best Practice in that particular category. Data about socio-economic condition of farmers, economics of various enterprises were subjected to coding for entry into MS Excel sheet for further analysis. Cost of various inputs, labour charges and profit from the enterprise were used to calculate B: C ratio of the enterprises.

Table 1. New innovations in livestock rearing by the farmers

Innovation/reinvention	Characteristic of innovation	Scalability
Stall feeding, silage preparation for sheep (Ramboullet breed) and emu farming	Stall feeding reduces the instance of taking the sheep to graze outside Bunkers have been constructed to store fodder	A minimum of 25 sheep and an acre of land to produce fodder are needed
Low cost dairy shed, locally made milking machine	The low cost shed is constructed in ₹ 2.0 to 2.5 lakh which is 50% lesser if cement sheets are used	It is necessary to have sugarcane as an alternative crop since there is need of supply of sugarcane trash

Table 2: New technology adopted by dairy and livestock farmers

New technology adopted	Characteristic of the technology	Source of information
Crossbreed of sheep (Ramboullet)	Crossbreed breeds which yield good meat and wool and has high demand in the market	Literature, field tours and TV shows
Emu rearing	Demand for meat and oil, annual net returns from each bird = ₹ 15,000	Other farmers
High-tech dairy unit	Preparation of feed (groundnut cake) using mechanized grinders Maintaining cleanliness (bathing each cattle daily using sprayer) Ensuring year round availability of milk by ensuring alternate batches of cattle for artificial insemination	Literature, TV shows, KMF (Karnataka Milk Federation)
Piggery (Yorkshire breed)	Fast growing and yields high quantity of meat as compared to other breeds	KVK

RESULTS AND DISCUSSION

The results of the study are presented and discussed under the broad headings of new innovations in livestock rearing, adoption of new technologies by the dairy farmers, important post production operations in livestock rearing, economic analysis of the enterprises, best practices of innovative dairy farmers and lessons learnt from these best practices.

New innovations in livestock rearing: Study found that silage preparation and its storage in bunkers; stall feeding

Table 3. Important post production operation in livestock rearing by the farmers

Best practice/innovation	Post production operation
Sheep (Rambouillet breed)	Persons appointed by government department go to his farm for shearing of wool
Emu farming	Has developed links with mutton stalls that purchase sheep from him
High-tech dairy unit	Karnataka Marketing Federation directly sends vehicles to procure milk, which is around 400 litre/day
Piggery (Yorkshire breed)	A small meat shop was opened to sell the pork meat Links with marriage halls to sell in bulk during marriages
High-tech dairy unit, sheep rearing	Contract farming by signing contract with different firms

of the sheep were the innovations made by a farmer which helped in reducing instances of outside grazing of the sheep (Table 1). A low cost cattle shed and milking machine was developed from locally available materials which pioneered low cost technology in the region. Both the innovations were scalable and to ensure good results, certain requirements were to be met by the farmers for its adoption. These innovations were made in concordance with the local culture, need of the farmers, and local wisdom. These findings are supported by a study of Ram *et al.* (2014).

Adoption of new technologies by the dairy farmers: The dairy farmers adopted new technologies, viz. adoption of crossbreeds, emu rearing, high tech dairy units and fast growing pig breeds (Table 2). While studying adoption of new technology, it is important to know the sources of information for farmers. The study found that literature was the main source of information farmers relied upon. This gives us insight that, if successful agriculture practices are documented and distributed to the farmers by the extension workers, it will serve as role model and lightening conductor to large number of small and marginal farmers in India. Tebug *et al.* (2012) found significant positive correlation with number of extension visits and adoption of new technologies by the dairy farmers.

The study revealed that progressive farmers had improved access to KVK and information from other farmers also. Asres *et al.* (2012) in their study also found that innovative dairy farmers had more access to information from different sources. In case of farmers adopting high tech dairy unit and crossbreed of sheep, combination of

Table 4. Economic analysis of enterprises

Innovation/re-invention in livestock rearing	Enterprises/crops (*)	Area (Acres)	Net returns (₹)	B: C ratio
Sheep (Rambouillet breed) and emu farming	Maize, carrot, beetroot, sheep rearing and emu farming(3)	20	9,130,000	4.04
Low cost dairy shed, locally made milking machine	Sugarcane, banana, dairy unit (3)	17	1,242,000	2.12
Emu rearing	Orange, pomegranate, onion, jowar, emu rearing (5)	11	833,000	3.92
Low cost high-tech dairy unit	Areca nut, cocoa, banana, dairy unit (4)	25	194,400	2.87
Fisher, zero farming in arecanut plantation	Paddy, areca nut, coconut, fisheries (4)	28	905,400	2.11
Piggery (Yorkshire breed)	Coffee, pepper, paddy, piggery (4)	3	414,800	2.98
Piggery, goat and poultry unit, vermicompost unit	Sericulture, ragi, field bean, horse gram, cow pea, fodder crops, goat rearing, piggery, poultry, vermicompost (10)	7	263,316	3.10
High-tech dairy unit, sheep rearing, organic cultivation of cardamom, sapota and mango	Tobacco, arecanut, coconut, coffee, cardamom, mango, sapota, oil	335	19,908,100	2.19

*The figures in the parenthesis refer to number of enterprises the farmer has integrated on his farm. Enterprises refer to different annual crops, horticultural and forestry species, dairy, sericulture, piggery etc.

different sources, rather than a single source of information was used. The farmer to farmer extension or horizontal extension had played a significant role here, hence, farmer associations and their linkage to scientists becomes an important aspect. Kokate (2009) highlighted one such case of Mahatma Phule Krishi Vidyapeeth (MPKV), Rahuri, where there is collaboration between farmers and scientists.

Important post production operation in livestock rearing:

In some cases, farmers had shown keen interest in the post production operation to increase the profitability and income (Table 3), most of them more or less related to marketing aspects. Two prominent methods used by these farmers could be sorted out, viz. direct marketing and contract farming. In direct marketing, emphasis was given on fetching good price for the produce by eliminating the number of middleman in supply chain. In contract system, farmers were able to reduce risk associated with the price fluctuation by signing contract with the contractor, to gain secure and sustainable income from the dairying and livestock rearing. Similarly, Asres *et al.* (2012) in their study of dairy farmers in Ethiopia found that innovative farmers had more access to market enabling them more profit than other counterparts.

Economic analysis of the farmers' enterprise: An analysis of successful farmers' enterprises (Table 4) showed that land holding varied from 3 acres to 335 acres. Farmers integrated 3 to 5 enterprises to get sustainable profitable income from these enterprises. B: C ratio of enterprises of farmers was in the range of 2.1 to 4.04, which indicates profitability of the enterprises. Some farmers had exhibited innovation by reducing the cost of construction of dairy shed by using locally available materials. The highest B: C ratio was found in case of the farmer who went for sheep and emu rearing. Crop and dairy enterprise apart from giving more income to farmers, generated more employment (Satyanarayan 2013) and innovations in dairy gives more income to the farmers (Tebug *et al.* 2012, Abdulai *et al.* 2005).

The net returns ranged from Rs 194,400 to Rs 19,908,100 (Table 4). The case of farmers having only 3 acres of land indicated that low land holding cannot be deterrent in increasing farm income by going for a commercial piggery unit. It was the successful combination of various enterprises along with dairy and livestock rearing that had increased the financial viability of the farm. The adoption of integrated farming system enabled farmers to cope up with volatile market prices of annual and horticultural crops. Farmers further added that dairying and livestock rearing enabled them to earn sustained and continuous incomes around the year.

Best practices in livestock rearing and lessons learnt

Small piggery unit catering to high demand: A piggery and poultry unit was being managed by a farmer with the belief that farming is profitable, provided it is integrated with other enterprises. Key to success here was practice of organic farming with the help of livestock rearing, membership of the Self Help Group (SHG), carefully

selection of the enterprise while selecting an enterprise and understanding of the demand supply gap.

Best practice: Integrated farming and livestock management proved to be the best practice. Piggery unit was started in the year 2006–07 with a single Yorkshire female pig, and it increased to 28 on January 2012. During peak seasons, more than 200 piglets were managed every year consisting of 3 different crossbreeds, exotic pig breeds namely large white Yorkshire, Duroc and Hampshire. From this piggery enterprise a net profit of Rs 4 lakh/ year was being earned by selling piglets and undertaking supply of pork for the various functions in the nearby village.

Lessons learnt: The right opportunity in the form of SHG helped to gauge the mood of other village women. The eco-system, family support and starting in small way made farmer to progress in the enterprise. Enthusiasm and patience of the farmers to take forward the enterprise as per the market demand were the factors behind success of the farmers.

Passion for animal rearing brings good returns

After understanding the concept of low-external-input-and-sustainable-agriculture (LEISA) from several literatures, a farmer adopted it on his 8 acres of land in Hasan district. Some important factors, which helped in success of the farmers in livestock rearing were knowledge of timely application of chemicals, energy and enthusiasm to work in the field and education.

Best practices: Integrated farming system consisting of livestock rearing and sericulture gave best results in some areas. In livestock rearing a piggery unit of 15 was managed, which was usually reared to make piglets for selling along with Giriraj hens (15), buffaloes (2), cows (4) and goats (4). The major portion of the revenue was generated from the livestock.

Lessons learnt: Passion for the animal rearing made the farmers to domesticate different types of animals like pigs, buffaloes, cows, goats and hens; which helped in increasing income of the farmers. By-products of these animals were used as input in agriculture, which enabled to adopt LEISA on farm. Before starting an enterprise one must view agribusiness as a project and plan it systematically.

Integrated farming system and dairy entrepreneurs

A farmer practiced organic farming in nearly 100 acres. Livestock in his possession included local breeds of chicken (200), sheep (150), dairy animals (15, HF; 70, Jersey; 65, local), apart from 60 honeybee boxes.

Best practice: Integrated farming system. Hi tech dairy was being followed since past 10 years in combination with both exotic and local breeds. Sheep rearing was done through stall feeding mainly for meat. Clean and hygienic method of milking, regular vaccination of the animals were performed by the farmers. Marketing aspects were being looked by an NGO.

Lessons learnt: Production and marketing all altogether different subjects. Challenging portion of marketing can

be outsourced to outside organizations like Producers Companies, Farmers' Organizations or private firms. This makes farmers to manage production function as systematically as possible. Mix of crop and animal enterprises (total 12) and keeping market demand at the centre of planning were key to success of the farmers.

Stall feeding of sheep and emu

A large farmer having 20 acres land believed that farming is profitable if practiced scientifically. Farmer had designed own equipments for stall feeding of sheep with the help of a local hardware shop. The same helped in reducing labour and also easy grazing for the sheep.

Best practice: Stall feeding of sheep breed Ramboulite for both meat and wool. To ensure sufficient nutrient to the animal, a daily chart of feed was prepared. Huge underground bunkers had been constructed to store the feed for ensuring year round availability. Because of large numbers of livestock reared, Government department itself used to send a shearing machine for the wool and also a doctor for the well being of animals. Emu rearing was followed for its meat and oil and its oil was famous in massage centres/wellness centres.

Lesson learnt: Knowing the market demand and judging correctly, which enterprise to start, farmers can become successful entrepreneurs. Banking upon a diverse output breed which offers less risk in an enterprise is the key. Supplement ventures also help in distributing and reducing risk in agriculture and animal husbandry. Animal husbandry mints money, if managed scientifically.

Successful dairy women entrepreneur practicing scientific and high tech dairying

A successful woman farmer (20 acres land) felt that for a woman farmer to be successful, one should be able to get the support of family, and should be in constant touch with the outside world to understand the newer technologies. Honesty, information seeking, scientific approach and contact with both government as well as private agencies were the key to success of the women dairy entrepreneurs.

Best practice: Around 70 cattle (Jersey and HGF) were being managed with rotation period which enabled availability of milk for an entire year. The rotation period signified that the gestation period of the cattle varied among different cattle and hence getting milk for the entire year. Further emphasis was given to the cleanliness of the cattle shed, everyday washing to avoid any disease that may occur. Using high jet water sprayers, only 3 labours were cleaning cattle and shed as well. Soon after the washing the cattle were left out in open field just beside the shed to take rest. Diet was balanced with carbohydrate, protein and calcium. For this combination of maize, pulses, *ragi* and polished rice were used.

Lessons learnt: If proper social support is available to farm women they can become successful entrepreneur by overcoming the constraints. Information seeking behavior, scientific orientation, contacts with private as well as

governmental agencies help women farmers in increasing knowledge and self confidence required for successful running of the enterprise.

Low-cost dairy unit helps in doubling the income

A women farmer having 17 acre land from Belgaum, a well known farmer in the field of low cost dairy unit, opined that dairy is definitely profitable, provided one focuses on cutting the cost of cultivation i.e. labour costs and adopt farm mechanization. A dairy of 40 milch animals was being maintained at the farm.

Best practice: Low cost Dairy unit. A cattle shed was constructed with very low cost by using sugarcane trash as the roof material. It kept the shed very cool and well aerated. Further, it could be removed easily and a newer one could be replaced by adding one more layer trash on the top. Locally made milking machines were used and hence there was reduction in cost and also reduction in labour. Highly nutritious Subabul and Azolla were used for the feeding.

Lessons learnt: Banking on local resources, minimized the cost and saved money was used as working capital. Coupled with this, ability to mobilize the local resources led to achieve best dairy standards. This implies that small and marginal farmers must look first to tap local resources in order to minimize the cost of production and have more capital available to invest on other aspects of enterprise.

Overall lessons learnt through successful livestock rearing

For a farmer, to become successful in farming enterprises, inclusion of as much as livestock as possible is a must because it best fits into the farming system and thrives on the existing resources while giving supplemental income to the owner and manure to the field. It insures farmers against crop failure in the event of natural calamities like drought and flood. Under the situation of climate change where natural events have become uncertain, to some extent dairying and livestock seems to be a better option with the farmers for sustainable agricultural income.

The study found that, proper planning and strategies for integration of the enterprises is needed to ensure a sustainable and enhanced income throughout the year. Livestock feed was scientifically derived by a combination of traditional and recommended set of practices. Farmers had increased their number of livestock every year, indicating that it was both profitable and sustainable. Though, there were good numbers of positive factors, there was lack of networking among the farmers, especially big and marginal farmers who worked in isolation. If, complimented, all the segments will get benefit from each other.

In conclusion, study reflected that for profitable and sustainable dairy or livestock rearing continuous innovations, inventions and reinventions by the farmers is essential. Innovative farmers continue to adopt new technologies, reinvent them by using local knowledge and wisdom to suit their requirement. One noteworthy thing was that these innovative farmers had very good contacts

with personnel's from KVKs, research organizations, state department and other progressive farmers. They are well ahead in searching market intelligence and making linkages with the traders and shop keepers locally as well as in other states, which reduces middleman's margin and increases the producers share in consumer's price. Important lesson learnt from these studies is that one should have qualities and traits like ability to select and integrate enterprise wisely; knowing and judging market demand correctly; searching and developing market linkages; constant seeking of information from different sources and practical intelligent to use locally available resources along with advanced technology. These traits can be imparted in other farmers through training for starting new dairy enterprises. Documentation of these cases will facilitate spreading of them through literature and replication in other parts of the country which in turn will contribute greatly in prospering and sustaining livestock and dairy sector.

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