Case studies on attributes of few dairy based innovations developed at the grassroots across India

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The study was conducted to explore the specific attributes of few selected dairy based innovations developed at grassroots across India. For this particular study, the ‘case study’ method was adopted. A total of nine dairy based innovations developed at grassroots, across different parts of India were selected, purposively. The uniqueness of these innovations lie in the fact that they are based on the particular culture from which they emanate and are based on the local wisdom. This study revealed that all dairy based innovations developed by farmers were having greater utility than other available options; because these innovations were developed, keeping in view the needs of farmers. Further, these were also found to be and found sustainable, because these innovations were developed, using local materials and wisdom. The costs of all nine innovations were found to be less than other available technologies in the market. Majority of selected innovations were found to be profitable except that of “Mixed Forestry”, wherein farmers get profit after long time and after involving hard work and investments. All selected innovations were found to be compatible to needs of the local farmers. Six out of nine innovations as developed by the respondents were not commercialized, because of the inability of farmers in converting the innovations into marketable products, coupled with less demonstrability of these innovations.

Keywords: Attributes, Innovation, Dairy farmers, Case studies, Indigenous technical knowledge

IPC Int. Cl.: AO1J, AO1K, A23G, A23J, A23C, A23K 1/08

In the ancient times, when there was no formal system of research vis-à-vis documentation, even then people used to devise some modus operandi in order to preserve such things albeit, such people who developed these technologies, passed away like “unsung heroes”, but their inventions are still being practiced under the domain of Indigenous Technical Knowledge (ITK). Subsequently, when the formal system of research came into existence, we shifted from traditional to modern system; however, at the same time, we are also losing, gradually, our invaluable ITKs, which have been accumulated after huge efforts on the part of several generations of our ancestors. In effect, ITKs happen to be sustainable in nature, requiring low external inputs; are suitable for local conditions and particular cultures; and are more environment friendly than modern technologies. Undoubtedly, on a short term basis, modern technologies help better in augmenting the productivity, as compared to the ITKs; but, in the long run, we face more negative consequences and immense challenges. So, it is better to focus on various innovations developed by the local people and/or farmers at the grassroots, that is, at the field level, before it is too late. Further, while obtaining information related to such indigenous and locally developed innovations, it is also expected to get an insight into the innate characteristics & attributes of such ‘Innovations’ being developed at the grassroots.

“Attributes of innovation(s)” are mostly based on the perception of potential adopters. The characteristics of innovations are subjective, qualitative as well as comparative to those of other existing technologies. In other words, attributes of any innovation are totally based on comparative judgment. Dasgupta (1989)1 has also opined that the characteristics of an innovation … inherent, or as perceived by its potential adopters … influence the rate of its diffusion in a social system. Rogers (2003)2

*Corresponding author
has categorized the characteristics of innovations into five sections: relative advantage (how much better the innovation is conceived to be compared to the innovation that it supersedes), compatibility (the degree to which the innovation is compatible with the values, past experiences and needs of potential adopters), complexity (the degree to which the an innovation is seen as complex and difficult to use), trialability (the extent to which an innovation can be tested and experimented on a limited bases) and observability (the extent to which the results of an innovation can be seen by others). Mahajan et al. (2000) reported that the extent, literature has focused on several product characteristics that contribute to slow diffusion rates including the innovation's trialability, observability, complexity, compatibility, and quality.

Accordingly, keeping all these afore stated & discussed issues in view, it was decided to conduct a study on some ‘Dairy based Innovations’ developed at the grassroots across various states of India, wherein, special emphasis was given on the ‘attributes’ of such innovation.

**Methodology**

In view of the nature as well as significance of the study, the “Case study” method was employed for this purpose. The cases were selected purposively on the basis of data base compiled and documented by National Innovation Foundation (NIF), Ahmedabad. Other sources besides NIF were also used, viz. NGOs, Progressive Dairy Farmers Associations (PDFA) of states like Haryana and Punjab, personal interactions with Scientists & KVK staff working at the grassroots, etc. Only such innovations were selected for this study, which were having relevance in the field of dairying. Finally, a total of nine cases namely ‘Hand-operated milking machine’ (developed by Mr Raghav Gowda), ‘Advance technology of drinking water for dairy animals’ (developed by Mr Divakaran Nambiar, Village- Vattipunna Veedu, P O- Parappa, District- Kasaragod, Kerala); ‘Animal Lifting Machine’ (developed by Mr J R Dhanraj, Vill+ PO-Kalkurchi, Belukurchi (via), District- Kasaragod, Kerala); ‘Mixed forestry’ (developed by Mr Jagat Singh Chaudhari, Vill+PO- Kotmalla, District- Rudraprayag, Uttarakhand); ‘Azolla as a ‘Bio-feed’ (Invented by Dr P Kamalasanan Pillai, Vill- Krishna Mandirum, Elamkulam Thazham, PO- Kalluvathukkal, District- Kollam, Kerala); ‘Multi-Purpose Processing Machine’ (developed by Mr Dharam Bir, Vill+PO- Damala, District- Yamuna Nagar, Haryana); ‘Calf cage’ (developed by Mr Jagdeep Singh, Vill+PO – Assal, District- Ferozpur City, Punjab); Forage Harvester’ (developed by Mr Gurtej Singh Chaany, Vill- Sirya Wala, District- Batinda, Punjab) and ‘Milking Parlour’ (developed by Mr Arvinder Singh, Vill+PO-Singhra, District- Karnal, Haryana) were selected for the study. All nine innovators were personally interviewed vis-à-vis attributes of selected grassroots innovations. In addition to personal interview method the observation method was also used for recording of attributes of selected innovators. Data was collected twice with a gap of four month.

**Results**

The selected innovations were expected to have unique attributes, based on local culture and local wisdom. An attempt was made to identify the unique attributes of the selected dairy based innovations as developed by the people at the grassroots. All the “Cases”, including the respective ‘attributes’, have been given below:

**Case-I: ‘Hand-operated milking machine’**

Mr Raghav Gowda was born in village Murulya, Taluka: Sulya of Dakshina Kannada ((Karnataka). In 1990’s, Mr Raghav Gowda, a teacher by profession, maintained a cow that used to produce 20-25 L of milk per day. It was very difficult for him to get entire amount of milk from that cow through manual mode of milking. Therefore, he decided to purchase a milking machine, but the cost of milking machine was so high (Rs. 90,000/-per machine), that it was very difficult for him to purchase it. Then, he started his experiments to develop a hand - operated milking machine. Firstly, Mr Gowda observed the working of the ‘Gutter spray pump’, used for spraying pesticides. He came up with the idea of using PVC teat cups and a plastic pipe on the Gutter pump. After modifying it for 15 times he was able to get proper hand operated milking machine, the specifications of which have been given in Table 1.

Till date, no hand operated milking machine is available in the market. In India, most of the farmers are small and marginal; and scarcity of continuous power supply is a serious problem. Therefore, this
machine will act as a very useful tool for the small dairy farmers. The specific attributes of this ‘hand-operated milking machine’ are given in Table 2 & Fig. 1.

**Case-II: ‘Advance technology of drinking water for dairy animals’ (developed by Mr Divakaran Nambiar)**

Mr Divakaran Nambiar was born in village Vattipunna Veedu, P O Parappa, District Kasaragod (Kerala).

After his education he was fully involved in farming. He started commercial dairy farming in the year 2000. Mr Divakaran faced the problem of drudgery while giving water to his cows. He also believed that the thirst of cows can’t be estimated. Then, he went on to develop an ‘Advance Technology of Drinking Water for Dairy Animals’, because he was unable to purchase ‘Water Trough’ available in the market. The specific attributes of the innovation are given in Table 2 & Fig. 2.

**Case-III: ‘Animal Lifting Machine’ (developed by Mr J R Dhanraj)**

Sometimes, dairy animals, especially the cross bred ones are unable to stand up due to deficiency of calcium or other nutritional elements in the body. For manual lifting of an animal, at least 6 labourers are required.

For solving this problem, Mr Dhanraj Kalkurchi (Vill+PO), Belukurchi (via), District- Namakkal (Tamil Nadu) came up with a solution, in the year 1999. He used an iron beam, made binding mechanism and one side attached tractor and another side cow attached with rope. The rope is applied on front and back side of the cow and is joined above the hump / back bone region and then is inserted through hook situated in the beam of 10 feet length (6 “ H- channel). The tractor is operated to lift the animal through lever. Once the cattle are lifted they are able to stand on their own and walk further within few minutes. The specific attributes of ‘Animal Lifting Machine’ are summarized in Table 2 & Fig. 3.
Table 2—Specific attributes of selected dairy-based grassroots innovations (contd.)

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<tr>
<td>1</td>
<td>Utility</td>
<td>There is no need of power. In case of power cuts during the process of milking; animals hold-up milk &amp; consequentl y milk yield decreases. This machine is very effective in such cases.</td>
<td>No labour is required. Continuous supply of water to animals.</td>
<td>For lifting one animal, at least 5-6 labours are required. This machine is an alternative to this manual mode. This is hundred per cent safe method of lifting animals.</td>
<td>It is a source of fuel, fodder, vegetables, medicine and livelihood from his forest. Reducing forest fire, which is the biggest problem in monoculture forest. Produces more oxygen.</td>
<td>Azolla feed is having more protein content than other available fodders. Productivity of Azolla is 1000 MT/ha. Feeding of Azolla to cows leads to increase of 16-18 per cent and 7-11 per cent in milk yield &amp; SNF respectively.</td>
<td>This machine can perform number of functions like extraction, pulverization, grinding sterilizing, boiling &amp; cooling at a time. This machine is very useful for milk processing. Value added milk products like Aloe Vera Milk, Aloe Vera Ice Cream, Arjuna Herbal Milk etc, can be prepared with the help of this machine. Proper feeding of calves is possible. Care on individual basis is provided. Convenient to labour to handle the calves.</td>
<td>This machine can perform cutting, chapping &amp; loading of fodder. Less time required. Less number of labours required.</td>
<td>This machine can perform cutting, chapping &amp; loading of fodder.</td>
<td>This machine is cost effective than other available options besides being multifunctional.</td>
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<td>2</td>
<td>Cost</td>
<td>The cost of this machine is only eleven thousand two hundred rupees excluding tax. Against this a farmer has to spend more than ninety thousand rupees for double cows milking machine operated through electricity.</td>
<td>The total cost involved in developing the machine is rupees two thousand.</td>
<td>For developing advance technology of drinking water for twenty dairy animals, farmers need to spend approximately five thousand rupees.</td>
<td>In growing turmeric 20-25 thousand rupees cost is incurred.</td>
<td>The cost of production of Azolla is Rs. 0.65/kg (Source: Pillai et al., 2002).</td>
<td>The cost of the machine is only one lakh sixty thousand rupees. This machine is cost effective than other available options besides being multifunctional.</td>
<td>The cost of one cage is nearly 700-800 rupees.</td>
<td>The cost of single machine is twenty lakh rupees.</td>
<td>The cost of single machine is twenty lakh rupees.</td>
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<tr>
<td>3</td>
<td>Benefit(s)</td>
<td>In term of investment farmers can save approximately eighty thousand rupees. Farmers can also save the expenses of electricity.</td>
<td>If farmers want to purchase a &quot;water trough&quot; available in the market, for each cow he has to invest rupees five thousand. By adopting this system farmer can save ninety thousand rupees for every twenty cows.</td>
<td>In manual lifting system 5-6 labourers are required. No labourer is required, as farmer can do it alone.</td>
<td>Net profit of more than one lakh rupees from turmeric yield. Other than this fuel, fodder &amp; vegetables for the whole year.</td>
<td>16-18 per cent increase in milk yield by feeding Azolla.</td>
<td>It is highly profitable as farmers don't require specific machines for specific purposes.</td>
<td>Mortality rate of calves will decrease from 20 per cent to 5 per cent.</td>
<td>The machine performs cutting, chapping &amp; loading of fodder &amp; saves labour.</td>
<td>By making this milking parlour a dairy farmer can save approximately 15-16 lakh compared to other milking parlour designs available in the market.</td>
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<td>4</td>
<td>Compatibility</td>
<td>This is highly compatible for the small dairy farmers. Labour scarcity is a serious problem in the field of dairying. Therefore, manual milking is not possible &amp; in such situation this machine is apt.</td>
<td>This technology is very much fit under Indian conditions because day-by-day availability of labour is decreasing.</td>
<td>Climate change is the biggest problem at present. This innovation is a great help in the conservation of nature. Mixed forestry will act as a panacea for the present day ecological disturbances.</td>
<td>Day-by-day pasture &amp; fodder are required. Now a day's our food habit is changing, the demand for processed and/or value-added product is increasing. This machine is apt for catering the changing food habit.</td>
<td>The mortality rate calves is very high at younger age because of improper management. This cage can help in individual care of calves.</td>
<td>Labour scarcity in dairying is the one of the biggest problems. In silage making we need lot of labour. Therefore, this machine is compatible in the present labour scare age.</td>
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<td>5</td>
<td>Demonstrability</td>
<td>This machine is user friendly. No special training is required for handling it.</td>
<td>This is very simple technology, anyone can easily develop. For developing the system, a farmer needs 10 plastic</td>
<td>The development of a mixed forest is a long-term process therefore, results of mixed forestry are</td>
<td>The Azolla plant is highly productive with the ability to double its weight in seven days. It can produce 9</td>
<td>This is easily portable from one place to another. For operating this machine no special skill is required. Quick results are difficult to demonstrate.</td>
<td>The cage is made of an iron rod and a bucket. It involves very simple technology; the results are difficult to demonstrate.</td>
<td>This is designed according to need of the dairy farmers. The results of machine can be easily observed.</td>
<td>This is a large system and the demonstration of this milking parlour is very difficult.</td>
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<td>5</td>
<td>Demonstrability</td>
<td>5 Demonstration buckets for 20 cows, fill valve lift arm, concrete tank &amp; connect with source. The trialability of technology is low because of being permanent in nature.</td>
<td>and rope connected with the animal on the other side.</td>
<td>visible after a long time.</td>
<td>tonnes of protein per hectare of pond per year. By feeding of Azolla, milk yield of cow increases by 16-18 per cent. Therefore, the benefits of Azolla can be easily demonstrated to the dairy farmers.</td>
<td>The production of Azolla is 400gm./sq.m./day. This is known fact that, when plant/algae grow in water they consume more CO2 than when grown in soil. That is why, production of Azolla is more eco-friendly than plant grown in soil.</td>
<td>The machine being multifunctional saves energy as compared to monofunctional machines.</td>
<td>This cage is made as per the local need, local wisdom and available materials.</td>
<td>This milking parlour is made with the help of local wisdom and modificatio ns of modern technology.</td>
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<td>6</td>
<td>Sustainability</td>
<td>This machine is eco-friendly, because electricity is not needed.</td>
<td>This machine is made by simple technology without having any adverse effect on the animals.</td>
<td>This is effective in terms of conservation of natural resources and/or biodiversity.</td>
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**Case-IV: ‘Mixed forestry’ (developed by Mr Jagat Singh Chaudhari alias Jangali)**

Mr Jagat Singh Chaudhari (Jangali) is from Village and PO- Kotmalla District- Rudraprayag (Uttarakhand). Forest fire and wood/fodder are most common problems in hilly area. He realized aforementioned problems and created mixed forestry model.

Then he started planting of trees like Pinus (Pinus sabiniana Douglas), Devadar (Cedrus deodara (Roxb. ex Lamb.) G.Don), Sagwan (Tectona grandis L.f.), Sheesham (Dalbergia sissoo DC.), Bamboo (Bambusa aurinuda McClure); fodders like Bhimal (Grewia laevigata Vahl), Khadik (Celtis australis L.), Siras (Albizia lebbeck (L.) Benth.), Bailaimati Babul (Acacia farnesiana (L.) Willd.); fruits and medicinal plants like Jamun (Syzygium cumini (L.) Skeels), Keemu (Morus alba L), Citrus (Citrus species), Jatoon (Olea europaea subsp. cuspidata (Wall. & G.Don) Cif. syn. Olea cuspidata Wall. & G.Don),
Dalchini (*Cinnamomum verum* J.Presl); flowers like Rose (*Rosa cymosa* Tratt. syn. *Rosa indica* L.), Gurhal (*Hibiscus rosa-sinensis* L.) and turmeric (*Curcuma longa* L.), Tea (*Camellia sinensis* (L.) Kuntze), spices (Cardamom, Ginger, etc.) and vegetables (*palak*, bottle guard, radish, lady finger, *tori*, etc.). He earns more than one lakh rupees, annually from a land holding of 1.5 ha, by selling turmeric every year. He gets fuel, fodder, medicines and fruits from his mixed forestry. The specific attributes of mixed forestry have been given in Table 2 & Fig. 4.

**Case-V: Azolla as a ‘Bio-feed’ (Invented by Dr P Kamalasanan Pillai)**

Dr P Kamalasanan Pillai, Village Krishna Mandirum, Elamkulam Thazham, PO- Kalluvathukkal, District- Kollam (Kerala) has invented *Azolla* as a bio-feed. *Azolla* is a free floating fresh water fern belonging to the family Azollaceae. Six species of *Azolla* are commonly found in the tropics and sub-tropics. It grows naturally in stagnant water in drains, canals, ponds, rivers and water bodies. *Azolla* is commonly used as a bio-fertilizer in paddy field.

Other than the bio-fertilizers, *Azolla* was also found to be a very nutritive and cheap organic feed supplement-cum-feed substitute for dairy cattle, poultry, pig and fish. *Azolla*, when grown for feed purpose should be hygienic; and there should be optimum production of biomass, preferably near the homestead. In paddy fields the biomass efficiency will be less, i.e. less than 50 gm/sq m/day against the possible optimum production of 400 gm/sq m/day (Pillai *et al.*, 2002). The comparison of bio-mass and protein content of *Azolla* with different fodders is given in Table 3.

Yield of *Azolla* is 1000 MT/ hectare @ of 300 gm/sq m/day even after considering the wastage space in between two *Azolla* bed (Pillai *et al.*, 2002). The feeding trials were conducted by Pillai *et al.*, 2002 and found 17–18 % increase in milk yield in HF and 16 – 17 % increase in Jersey in 20 and 25 % substitution of *Azolla* against 8 % in groundnut substituted treatment. There was an increase of 7–11 % in SNF in 20-25 % *Azolla* substitution and 7 -5 % extra *Azolla* against groundnut cake as substitute. There was 11 % increase in fat in 15, 20, 25 % substitution with *Azolla* against 9 % in groundnut cake. Goat, pig, rabbit, duck and fish showed an overall increase of 20 – 25 % in body weight and productivity. The specific attributes of innovation are summarized in Table 2 & Fig. 5.

**Case-VI: ‘Multi-Purpose Processing Machine’ (developed by Mr Dharam Bir)**

Mr Dharam Bir, Vill+PO- Damala, District- Yamuna Nagar, Haryana has developed ‘Multi-purpose Processing Machine’. The machine is a vertical free standing cylindrical unit mounted on four legs. The raw material is fed from the top and the processed output can be collected at the bottom. The machine consists of an autoclave unit for sterilization, a boiler unit for boiling, the extractor unit for extracting juice or gel, a drive meant for a source of power to be attached with the apparatus. The extractor unit comprises of a frame, a condenser with flexible coolant, a set of blades connected to the frame and a grinding system. The main chamber is enclosed with an oil jacket to avoid direct heating of the herbs. However, no single machine was available in the market, which performed multi-purpose activities such as extraction, pulverization, sterilizing, boiling, mixing and grinding the materials. This
machine also acts as a boiler, sterilizer and cooker and is also used for extracting the juice or essence from various plants and/or parts of plant. Interestingly, the machine also allows the operator to use heating as an option and not deploy it if only pulverizing and grinding is required for certain produce types. The specific attributes of machine are given in Table 2 & Fig. 6.

**Case-VII: ‘Calf cage’ (developed by Mr Jagdeep Singh)**

Mr Jagdeep Singh is from Vill- Assal PO District- Ferozpur City, Punjab and is a commercial dairy farmer who lost many calves from his dairy farm which made him to think for the solution.

In 2008, he got a chance to visit USA dairy farm with the financial support of Nestle. In USA, dairy farmers were doing very intensive “calf care program”. He got some ideas from USA but their calf cage was so expensive nearly amounting to twenty thousand rupees per calf. He could not afford this arrangement. Then he went on to develop “calf cage” for special care of calves. The unique attributes of the innovation is given in Table 2 & Fig. 7.

**Case-VIII: ‘Forage Harvester’ (developed by Mr Gurtej Singh Chaany)**

Silage making is a very difficult task for the dairy farmers as it requires a lot of labor.

Some dairy farmers requested Mr Gurtej Singh Chaany, Bajakhana-Barnala Road, Near Grain Market, Village: Sirya Wala, District- Batinda, Punjab to develop a silage making machine that can perform cutting, chaffing and loading of fodder. Mr Chaany had already developed stalk harvester, straw collector and Chaany tree saw. Then, he started thinking about developing such a machine. Finally, in 2010, he developed a ‘Forage Harvester’. Specific attributes are given in Table 2 & Fig. 8.

**Case-IX: ‘Milking Parlour’ (developed by Mr Arvinder Singh)**

When, Mr Arvinder Singh, Village and Post- Singhra District- Karnal, Haryana was unable to do milking through manual system, he decided to make a milking parlor. He consulted private companies for making the milking parlor. But it was so expensive; he had to spend nearly 20-22 lakh rupees. Then, he designed his own milking parlor. The specific attributes of his innovation are given in Table 2 & Fig. 9.

### Table 3—Comparison of bio-mass and protein content of Azolla with different fodders

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<thead>
<tr>
<th>Sl.No.</th>
<th>Item</th>
<th>Annual production of Bio-mass MT</th>
<th>Dry matter content MT</th>
<th>Protein content MT</th>
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<tr>
<td>1.</td>
<td>Hybrid Napier</td>
<td>250</td>
<td>50</td>
<td>4</td>
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<td>2.</td>
<td>Kolakattai grass</td>
<td>40</td>
<td>8</td>
<td>0.8</td>
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<tr>
<td>3.</td>
<td>Lucerne</td>
<td>80</td>
<td>16</td>
<td>3.2</td>
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<td>4.</td>
<td>Cowpea</td>
<td>35</td>
<td>7</td>
<td>1.4</td>
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<tr>
<td>5.</td>
<td>Subabul</td>
<td>80</td>
<td>16</td>
<td>3.2</td>
</tr>
<tr>
<td>6.</td>
<td>Sorghum</td>
<td>40</td>
<td>3.2</td>
<td>0.6</td>
</tr>
<tr>
<td>8.</td>
<td>Azolla</td>
<td>1000</td>
<td>80</td>
<td>24</td>
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*Fig. 5—Azolla As A ‘Bio-Feed’ invented by Dr. P. Kamalassanan Pillai*

*Fig. 6—Multi-Purpose Processing Machine developed by Mr. Dharam Bir*

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Discussion

Hand operated milking machine developed by Mr Raghav Gowda is having a lot of utility for small dairy farmers. In terms of cost, this is very much cheaper than the milking machines available in the market. It was found in this study that this machine is more compatible and beneficial for the small dairy farmers than other groups. It was also found that this machine is more sustainable than any other milking machine available in the market.

This study, revealed that “Advance Technology of Drinking Water for Dairy Animals”, as developed by Mr Divakaran is having immense utility, in terms of reducing drudgery, and also by providing continuous supply of drinking water to animals. This is very cost effective, as compared to the available “water trough” in the market. Besides, shortage of labour happens to be a very serious problem in the dairy sector. So, this technology could be very helpful for the dairy farmers. This technology was developed with the help of locally available materials. Therefore, this is very simple apropos the working principle, apart from being eco-friendly in nature.

An in-depth study of attributes of Animal Lifting Machine developed by Mr Dhanraj revealed that the machine is having great utility. For developing this machine farmer needs to spend only two thousand rupees. This is very simple and farmers can easily handle and operate this machine.

Under this study the attributes of mixed forestry revealed that there are number of benefits like fuel, fodder, vegetables and money throughout the year compared to the mono-culture forest. It was also found that development of mixed forestry is long term process that is why the demonstrability of innovation is very poor. This innovation is very useful for people belonging to the Himalayan region because people in the region are facing acute shortage of fuel and fodder. Under this study it was also delineated that mixed forestry is very helpful in conservation of natural resources and/or bio-diversity and is also helpful in protecting climate change compared to the monoculture forest.

This study, revealed that Azolla as a ‘Bio-feed’ to animals is having more utility for the dairy farmers. The cost of production of Azolla is Rs. 0.65/kg which is very less than that of other fodders. This was also found that by feeding Azolla, the milk yield of the dairy animal can be increased by 16-18 %. The high growth rate of Azolla and tremendous increase in milk yield of cow increase the demonstrability of Azolla as a bio-feed. Azolla is a high CO₂ consuming fern, grown in water bodies; and it is very effective in decreasing the CO₂ content in atmosphere.
The carbohydrate and fat content of Azolla is very low. Its nutrient composition makes it a highly efficient and effective feed for livestock (VK-NARDEP, 2010). Giridhar et al., (2012) reported that, Azolla improves monthly milk yield by 10 liters per animal in the low yielders, nutritive feed supplementary for the livestock and cost of milk production can be reduced by replacing a part of concentrate requirement with Azolla. INDG (2006) stated that Azolla can be used in animal feed and it is a potential feed ingredient for broilers; it is an income generating crop. All these studies are further strengthening reported innovation of Mr. Pillai “Azolla as a bio-feed”.

An in-depth study of the attributes of the multi-purpose processing machine, as developed by Mr Dharam Bir revealed that the machine is having immense utility, as it performs many functions of processing. This is also a cost effective one, which can be easily operated and handled. The output of machine can be quickly observed.

Under this study, it was found that, the calf-cage was developed by using locally available material and wisdom. It is very cost effective in calf care than other calf-cages. This is very useful and sustainable and is as per the needs of the dairy farmers.

It was found that the forage harvester is more effective in silage making since it saves lot of labours. This is also cost effective than other available machines in the market. The cost of this machine is only 20 lakh rupees, the cost of other available machine start from 30 lakhs up to one crore. This was also found that the machine is designed according to needs of the dairy farmers and results of machine can be easily observed.

This study stated that the ‘milking parlour’ developed by Mr Arvinder Singh is having more utility, in terms of space, cleaning and milking of cows. This is very cost effective, as compared with other designs of milking parlour as available in the market; the dairy farmers can save up to Rs.15-16 lakh. The demonstration of this system is quite difficult because of being immobile in nature. It was also found that this system is more sustainable because it is made with the help of local wisdom and modification of modern technologies as per the local need.

It was also found that only three innovations, namely hand operated milking machine, multi-purpose processing machine, and forage harvester have been commercialized; while one innovation, that is, “Azolla as a Bio-feed” was popularized on a large scale, with the financial assistance from NDDB and DBT. Other five innovations were popular among fellow farmers. It clearly indicates that some of the afore-mentioned innovations could not be commercialized on account of inability of the concerned innovators in converting the innovations into marketable products.

Significance of study

This investigation is a maiden attempt to study attributes of selected dairy based farmer innovations. This study revealed that the development of the selected innovations was mostly in response to a ‘problem’ faced by the particular farmers. This study revealed that all nine grassroots innovations used local material and/or wisdom. Therefore, these innovations can be only generalized for that particular social system. This study revealed that only three innovations have been commercialized; while one innovation, that is, “Azolla as a Bio-feed” was popularized on a large scale, with the financial assistance from NDDB and DBT. Therefore, it is needed to provide seed capital to grassroots innovators for commercialization of their innovations. It was also found that grassroots innovations were having cost effective, greater utility and more sustainable than available technology. The Grassroots innovators may be participated in participator technology development.

This study has opened new vistas of research apropos Farmers’ Innovations in our country.

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References