

LIVESTOCK EXTENSION

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LIVESTOCK EXTENSION - NEED FOR A PARADIGM CHANGE

While basics of extension remain the same, livestock extension needs different treatment. It is time to relook at livestock extension and bring about a paradigm change, argues DV Rangnekar.

India has the largest number of families depending on livestock for livelihood and majority of these are small holder-resource poor families. Livestock rearing supplements family income and generates gainful employment in rural areas, particularly among the landless labourers and, small & marginal farmers. Research showed that livestock rearing has positive impact on equity in terms of income, employment and poverty reduction in rural areas (Singh and Hazell, 1993; Thornton et. al 2002 and Birthal and Ali 2005).

Livestock perform multiple functions in the livelihood of rural families. It is common to recognize the economic benefits of livestock but the livestock serve different purposes to their owners. Dairy cow for example is perceived as a milking machine and all the efforts of the researchers and policy makers are geared to increase its milk production but for dairy farmers the cow serves different purposes (asset for a landless agricultural labour, source of "milk money" for milk producers, dung for agricultural land owners, source of daily income for resource poor families and in addition to serving a variety of social purposes). Women play much larger role in livestock production compared to other sub-sectors of agriculture. Research evidence indicated that women spend about 3 to 5 hours on livestock rearing activities.

There is an ever-increasing demand for livestock products in the country and livestock development can be an effective pathway for poverty alleviation. Livestock offers wide scope as the demand for livestock and livestock products is increasing over the last decade and is expected to double over the next two decades (Delgado et al, 1999, Dastagiri, 2004). This increase is attributed to increase in per capita income, urbanization, change in tastes and preferences and increased awareness about food nutrition. Livestock sector is likely to emerge as an engine for agricultural growth in the coming decades. It is also considered as a potential sector for export earnings. How to convert this increase in demand to benefit the poor livestock owners is a challenge that needs to be addressed?

Livestock Development Approaches: Key Issues

Livestock development and extension programmes in developing countries were reviewed way back in 1989 by Rollings, later by Mathewmanet al in 1996 and they pointed out several limitations in these programmes. Bhattacharya and Jhansi Rani (1995) in a working paper on Bovine Extension in Andhra Pradesh analysed planning and implementation of extension programme as practiced in the state and strongly recommended paradigm shift. The situation is similar in most other states as can be

seen from reports of Chander et al (2010) and Ravi Kumar and Chander (2011) who studied livestock extension activities of departments of Animal husbandry of some states. Rangnekar (2014) stressed the need for realizing potential of livestock development for sustainable livelihood development and extending benefit to the underprivileged families. He stressed the need for a paradigm shift in livestock extension for utilization of this potential. Major drawbacks identified in these reviews and through my own personal experience and observations in rural areas are summarized below:

- **Wrong plug –commodity approach is adopted in livestock development, extension and research while livestock keeping is part of a complex livelihood system of the rural families and livestock play multiple roles.** Though the farming systems approach (in contrast to commodity approach) has been found beneficial to the farmers, Indian researchers are still following the commodity approach. It is high time to recognize that livestock production is an integral and often essential part of several mixed farming systems in the country. We need to concentrate on increasing the effective use of different sub systems by adopting a farming systems research approach which recognizes that the household, crop and animal subsystems are closely integrated and interdependent.
- **Equity syndrome –most research outputs are high input oriented while ‘low external input production systems’ prevail in the country.** Researchers evolved several crossbreds to increase the production of milk, meat and eggs. But all these crossbreds whether it is a crossbred cow, goat or poultry require high inputs to get the expected results. This is one of the reasons why these high input- high output technologies did not find favour with the resource poor families. On the other hand these crossbreds proved their worth in “high input and high output” situations.
- **Lack of fit and functional gap - research is mostly laboratory based and there is virtual absence of ‘adaptive research’ before propagating technologies and recommendations (where extension can play a role).** Conducting on farm trials by the researchers and extension personnel jointly on the farmers’ fields help in fine tuning the technologies to suit to the needs of farmers.

Unfortunately, very rarely on-farm trials to test the livestock development technologies are conducted. The KVKs claim on conducting

on-farm trials is mainly confined to crop production technologies.

- **Weak linkages between research/ extension and development due to virtual absence of planned and systematic interaction between these systems.** There are no two opinions that the researchers and extension personnel work in isolation though they claim that they are working for the benefit of the farmers. Although, achieving better coordination between the researchers (universities/colleges/institutions) and development departments (agriculture or animal husbandry) is a “win-win” situation for all the stakeholders, hardly there is any coordination between these institutions leading to inefficient use of the scanty resources. Though organizations such as the Rajiv Gandhi Institute of Veterinary Education and Research, Puducherry (RIVER) tried to bridge the gap between academic institutions and development departments in the livestock sector in southern states through organizing regional workshops, the success has been limited.

Livestock Extension: Current Status

A critical look at Livestock extension as commonly practiced, show that:

- **Transfer of technologies (off the shelf) is considered goal/objective of livestock extension and is implemented as a targeted programme with little consideration for variation in situations.** Urea treatment of crop residues is a good example in this context. Demonstrations of this technology were arranged all over the country (as a targeted programme). The technology was adopted by farmers as long as subsidy was provided and given up after it was withdrawn. Vaishali, in Bihar, is one of the very pockets where a good number of farmers adopted this technology. Roy and Rangnekar (2005) studied reasons for adoption in Vaishali area and reported that the main reason was that the process of urea treatment of straw fitted with the straw handling and storage system of that area and helped in storage of straw. However the impact of this practice on dairy animals was marginal. Similar conclusions were drawn in the e-conference, organized by the FAO in 2013 on adoption of feed technologies.
- **Livestock services, input supply and technology transfer are the main activities taken up in livestock extension programmes and education/improving knowledge, awareness to help animal owners make better**

decisions/choices are neglected (Chander et al 2013) It is unfortunate that the emphasis is on delivery of inputs rather than “educating the farmers” which is the essential element of extension. Research has shown that investments in exchange of knowledge, rather than one way transfer are much more effective than programmes aimed at input supply alone.

- **Messages/recommendations are centrally generated and propagated without considering variations in agro-ecological and socio-economic aspects and hence the acceptance is poor.** Topdown approach prevails as evident from poor participation of livestock owners, neglect of traditional knowledge and experience of livestock owners. Some of the NGOs (like BAIF and PRADAN), involved in livestock development, have adapted the approach of preparing extension material in a decentralized manner and involving the community in the process.
- **Most of the recommendations and technologies are high input oriented,** although it is known that majority of livestock owners are resource poor. The need for adoption of a Pro-poor approach and need for an intermediate step to ‘Pre-test’ recommendations and technologies for appropriateness before propagating these on a wider scale has been stressed by Rangnekar (2006 and 2014). Pre-testing has to be with participatory approach as it is crucial to get views of livestock owners about appropriateness of recommendations or technologies.
- **Focus is mainly on large animals (bovines)** while small animals are neglected and hence the resource poor are deprived of benefits they can get from keeping small stock (sheep/goat/pigs).
- **Livestock extension policy with a sound plan of implementation does not exist.** While many states have framed livestock policies and it recommends need to strengthen livestock extension but planning and approach of livestock extension follows that for crops. While basics of extension would remain the same, livestock extension needs to be planned somewhat differently in view of some characteristics of livestock production that are distinctly different from crops, as indicated below.
 - Livestock perform ‘multiple functions (economic, input, output, risk coverage and socio-cultural)’ in the livelihood of rural families.

- Livestock have stronger linkage with the socio-cultural aspects of rural society.
- Impact of intervention takes longer time with livestock.
- Resource poor families own majority of the livestock and make major contribution to livestock produce and hence recommendations and technologies have to be carefully selected before propagation.
- Women play a major role in livestock production.

Based on studies of extension activities of Animal Husbandry Departments, Chander (2013) and Chander et al (2013) made similar recommendations.

- **New challenges and demands for Livestock extension.** Rangnekar (2006 and 2014) pointed out the need for livestock extension to adopt a ‘pro-poor approach’ and take cognizance of newly emerging development issues. The major emerging development issues are summarized below:
 - Information about market changes and facilitating market links.
 - Promoting social mobilization and formation of interest groups for providing organizational back up and reducing dependence on other organizations.
 - The need for making livestock production environment friendly and to mitigate or cope with impact of climate change.
 - Production of clean and safe livestock products.
 - Promote sustainability based on principle of 3 Ps (People, Planet and Profit).
 - Pay due attention to ensure ‘Welfare of Animals’.

Way Forward

The role of extension has currently broadened from an intermediary between science and practice to include a wide range of roles, such as mediation, knowledge brokering, facilitation, demand articulation, organizing producers etc. (Sulaiman and Davis, 2012). There is a need to use this knowledge while developing relevant extension models to address the emerging challenges in different livestock production systems. Unfortunately, these issues do not get the needed attention from the policy makers although they recognize the importance of livestock extension in the XII plan as well as the heavily funded National Dairy Plan.

The Working Group on Agricultural Extension for

Agriculture and Allied Sectors for the 12th Five Year Plan (2012-17) observed that “*Extension support is weak or non-existent in the case of animal husbandry and fisheries. As separate extension machinery for animal husbandry and fisheries are not going to be feasible in many states, this has to be integrated with ATMA. In districts where livestock and fisheries play a major role, staffing structure within ATMA and KVKs should be modified to include more staff with specialization in these sectors*”

http://planningcommission.nic.in/aboutus/committee/wrkgrp12/agri/wg_agriextn.pdf

A paradigm change in livestock extension requires the following:

- **Situation analysis** of the prevailing livestock production systems in each region has to be undertaken with the participation of key livestock producer's (to understand their needs and perceptions and knowledge) while planning extension strategy and implementing it. There needs to be shift in emphasis from “high input and high output” solutions to “low input and low output, if not low input and high output” solutions to help the resource poor livestock owners.
- **‘Pre-testing of technological recommendations** to confirm their appropriateness for livestock owners of different socio-economic strata, before wider application. There is a need to shift from “researcher managed tests” to “farmer

managed tests” of the technologies.

- **Decentralized production of extension material/tools** (except recommendations for vaccination and other such measures to be uniformly followed.) with pre-testing the messages with women/men livestock owners. Messages should be in easily understandable language (using local language and not literal translation) and well illustrated with minimum text. This approach has been effectively adopted in livestock development programmes implemented by NGOs like the BAIF and PRADAN in the states of Jharkhand, Odisha and West Bengal.
- **Extension meetings/ training programmes for women should be planned at their convenience**, should be of short duration, deal with subjects of current importance and should be practical oriented (with very few lectures).
- **Training and orientation of staff** involved in planning and implementation of livestock extensions should be undertaken – periodically and is crucial for success of livestock extension. The Indian Veterinary Extension Forum (IVEF) can play a key role in this process. Initiatives by Animal Husbandry departments of Odisha and Tamil Nadu and NGOs like BAIF and PRADAN of training/orienting their staff in extension and communication, besides training in technical subjects, are noteworthy.



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BEYOND TREATMENT AND BREED IMPROVEMENT: WHY EXTENSION IS CRITICAL FOR INDIAN LIVESTOCK SECTOR?

The focus of livestock development in India should shift from breed improvement and disease management to strengthening knowledge provision to livestock keepers, argues Mahesh Chander.

While the role of extension services in enhancing crop production and productivity is widely recognized, livestock extension never got the attention it deserves and this has been one of the reasons for low productivity of India's livestock sector. The focus of all the five-year plans in India has been on breed improvement and improving health services with inadequate attention given to knowledge provision to livestock keepers. For want of coherent livestock extension policy and programmes, livestock extension activities in India continue to remain sporadic, casual, occasional and highly unorganized and therefore do not effectively meet the requirements of a vast majority of livestock keepers.

Box 1: India's livestock sector: some glaring facts

Enormous livestock (530 million) and poultry population (489 million) notwithstanding, per animal productivity in India is much lower than that of the world average for milk, meat and eggs as also the quality of products is poor. Milk productivity per lactation is only 987 Kg in India against world average of 2038 Kg. Despite significant investment in artificial insemination and crossbreeding programmes during the last 5 decades, the crossbred cattle population has remained below 15% with huge regional variations. The claim of being number one milk producer in the world is often ridiculed when contrasted with the livestock numbers which are manifold more than that in the high milk producing countries like Israel, New Zealand, Australia and USA. The per capita milk, meat and egg availability too is far lower than that of the requirements as recommended in a standard diet. The per capita annual consumption of meat, milk & eggs is 5.1Kg, 65.2Kg and 1.8Kg, respectively against world average of 41.2Kg, 82.1 Kg and 9 Kg, respectively (FAO, 2009).

Under the central sector scheme, the investments in livestock extension activities have also been consistently very low. Moreover there has not been any exclusive livestock extension programme sponsored by the government. For instance, in the 11th plan, a meager Rs 15 crores was allocated to Department of Animal Husbandry Dairying and Fisheries (DAHDF) under central sector schemes for livestock extension activities. Here too, Rs 10 crores was earmarked for establishment of private veterinary clinics while only Rs 5 crores was meant for strengthening animal husbandry extension. This small allocation too remained unutilized till close to the end of the 11th plan. Similarly the investment on livestock extension activities at the state level also remained very low.

As a result, only 5% of farm households in India access any information on animal husbandry against 40% farm households accessing information on crops as per NSSO survey done in 2003 (GOI, 2005). The same survey also revealed that public sector extension services are not the preferred option for accessing information on modern technologies on livestock production. Whatever little extension efforts are there, these are concentrated around large ruminants or dairy animals in particular. The large majority of small holders and the landless livestock keepers rearing goat, sheep, pigs and backyard poultry are largely ignored under the technology transfer schemes of various agencies. The much discussed National Dairy Plan, which is currently under implementation, too would cover only dairy animals.

India's Planning Commission in its document, 'Agriculture Strategy for 11th Plan: Some critical issues' rightly observed that "unfortunately, extension advice is almost totally absent in animal husbandry and thus, special efforts need to be made in this area". There is no coordination and sharing of information and resources among multitude of agencies claiming to have extension component in their array of activities. The 12th Plan sub-group on Animal Husbandry constituted by the Planning Commission recently observed that extension services for livestock have so far been a non-starter severely hampering its growth (Planning Commission, 2012).

Though the State Animal Husbandry Department (SDAH) is the major stakeholder in livestock development (having its vast infrastructure like veterinary hospitals, dispensaries, personnel and budget), its primary focus is on diagnosis/treatment of animals and breeding services for which it has a clear mandate (Chander et al 2010). The veterinarians and other staff like Livestock Extension Officers/Livestock Inspectors of the SDAH hardly have any motivation, appreciation, support, equipment, budget as also the required training to take up extension educational efforts (Ravikumar, & Chander, 2011). The paravet initiatives taken up by some of the state governments also failed to bridge the gap since the paravets too often compete for treatment & breeding services with the veterinarians leading to conflicts, while lacking in proper training on knowledge delivery to the livestock owners.

The investment in terms of budget allocated as well as the expenditure incurred on livestock extension activities by most of the SDAH in general is very low (1% to 3% of total budget), while 10% is considered as optimum per cent of budget allocation in a developing country context. In spite of clear recommendation by various committees

including 10th and 11th plan working groups on Animal Husbandry Extension, only 8 states have created an exclusive extension wing within the SDAH. It is important for the SDAH to streamline its extension activities by ensuring well designed programmes, sufficient funds, infrastructure and human resources development strategy to train its manpower on delivery of extension support to livestock producers. Though the importance of extension policy has been sufficiently emphasized internationally and in Asian countries (Sulaiman and Hall, 2005), there is no policy for livestock extension in India.

In India too women face disproportionate challenges compared to men in accessing livestock services and information. Women account for 55% of livestock farming labour, whereas, their participation in works related to the care of animals is above 77%. Rural women make up for 93% of overall employment in dairying and their average contribution to the entire farm production is estimated around 45% to 56% of the total labour. Given the strong informal association of rural women with livestock, it is necessary to create matching programmes with sufficient funds so that their participation gets institutionalized. Several studies have shown that most of the conventional training and extension programmes are oriented at men. It would be effective, if women farmers are reached through women extension workers. Appreciably few dairy co-operatives have done some good work in this regard, but such initiatives need more encouragement and policy support.

In India, animal owners often do not follow scientific animal rearing methods and in most cases do not feed balance ration to their animals. Deworming and vaccination are not followed as prescribed and many take their sick animals to quacks ignoring veterinarians and all these have contributed to low productivity and high livestock mortality. Here lies the importance of veterinary/livestock extension professionals who can take up the responsibility to educate and motivate livestock owners to follow good livestock production practices. This would lead to increased demand for veterinary services, more number of livestock owners seeking professional advice including visiting veterinary hospitals. It's a challenging task and often more difficult than treating individual animals, since here we have to deal with humans having complexities of mind, attitudes, perceptions, socio-psychological barriers, level of literacy, level of knowledge etc. This underscores the need for closer interactions between field livestock personnel and veterinary faculty as also the need for refresher training on livestock extension for field extension personnel

and also the importance of specific livestock extension programmes.

Having said this, it would certainly help if qualified people in animal husbandry and veterinary sciences go for higher education in veterinary and livestock extension education provided they acquire skills good enough to change the behavioral complex of livestock owners, making them receptive to new ideas/practices. It is heartening to note that many veterinarians are currently coming forward for higher education in veterinary extension education. But they should have opportunities to practice their newly acquired skills once they go back to their respective organizations. The livestock sector in India therefore needs a serious rethinking on how to support livestock owners with new knowledge so that they can increase their productivity and income and thereby fully realizing livestock sector's huge untapped potential.

Some of the practical steps include:

- Working out an implementable National Livestock Extension Policy (NLEP) that would effectively systematize livestock extension interventions.
- Establishing a Directorate of Livestock Extension at central level within Department of Animal Husbandry, Dairying and Fisheries and it should be mandated with the responsibility to plan, implement, monitor and coordinate livestock extension activities across the country.
- Initiating a major program on livestock extension (including all livestock species) with specific focus on women and livestock development during the 12th Plan. There should also be a provision for training and deployment of women extension workers for livestock extension at the Panchayat level.
- Including more livestock extension activities under Krishi Vigyan Kendra (KVK) action plans and ATMA (Agricultural Technology Management Agency) activities.
- Developing collaborative programmes for livestock extension with private sector, NGOs, producer groups/co-operatives, women SHGs and para extension workers involved in the livestock sector.
- Creating an extension and training wing within SDAH at state headquarters with regional/ local wings (staffed and equipped with trained livestock extension specialists and supporting infrastructure) and should allocate at least 10% of the departmental budget for extension activities covering all livestock species.
- Developing capacities among livestock development and extension personnel from all sectors through curricula reforms as well as through design and implementation of appropriate training programmes.

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INEFFICIENT EXTENSION SERVICES: LIVESTOCK OWNERS BEAR THE BRUNT

Today there is nothing like livestock extension in the country. Its necessity is neither recognized by the policy makers nor demanded by the livestock owners. The resultant knowledge gap has been leading to several serious consequences, not only for livestock owners but for the society at large, argue, SVN Rao and K Natchimuthu.

Livestock owners need three types of (integrated) support:

- Extension and advisory services (to enrich the knowledge and improve the skills of livestockowners)
- Availability and accessibility of input service such as semen, vaccines, medicines, equipments, instruments, feed etc and
- Delivery of the technical service by the veterinarian (Vet) or Para-Veterinarian (Para-Vet).



In general, the delivery of extension and advisory services cannot stand alone as it depends upon the other two i.e. input service and technical service. The livestock owners need the help of a vet or Para-Vet for getting their animals inseminated, diagnosed for pregnancy, dewormed, vaccinated, treated etc. As is well known, a field vet is supposed to perform all the three services but his focus is mainly on breeding and treatment of animals. His role as extension advisor is totally neglected as it is neither demanded by the livestock owners nor by his superiors. In India, the livestock owners as well as the information providers do not value information, whereas they prefer to receive services such as Artificial insemination, treatment etc. even on payment basis as these result in visible immediate benefits.

Livestock owners are ready to pay for door step delivery of breeding and treatment services (Ahuja et al, 2008) but not for extension and advisory services (Sangameswaran, 2014) . The net result is that the knowledge of the livestock owners on scientific management of livestock is very poor. Today there is nothing like livestock extension in the country. Its necessity is neither recognized by

the policy makers nor demanded by the livestock owners. A cursory glance at the Report of the Working Group on Animal Husbandry and Dairying for the 12th Five Year Plan (Planning Commission, 2012) and the website of the National Dairy Plan (<http://www.nddb.org/ndpi/English/Pages/NDPI.aspx>) will clearly reveal this. The irony is that many of our extension professionals have also failed to impress upon the policy makers on the significance of the livestock extension and advisory provision.

Several actors, but no Extension

Though several actors are present in the livestock sector, there is very little extension.

Department of Animal Husbandry (DAH), the main service provider in all the states is not practically involved in extension and advisory service delivery. It never considers it as its responsibility as evidenced by the meaning it attaches to extension (delivery of inputs) and the paltry sum allocated to the extension work (Ravikumar and Chander (2006); Chander, 2013). Even the breeding and health care services are focused largely on cattle and buffaloes (owners are also interested and willing to pay for these services), restricted only to vaccinations that too during outbreaks (in case of sheep and goat) and almost nil in case of backyard poultry, (except Ranikhet disease vaccination at the dispensary). Pigs are never on its agenda, except in Goa and north eastern states. Although DAH has a wider net work in the states, its effective reach is limited to only few villages around the veterinary dispensary/hospital. In many states the vet is losing his/her technical identity as he is being involved in non technical activities such as feed distribution, purchases of animals, identification of beneficiaries of various schemes, maintenance of several records etc.

Krishi Vigyan Kendra (KVK) is considered as a centre for transfer of technology in a district for all the agricultural technologies which include crops, livestock, horticulture etc.

More than half of the 641 KVKs do not have animal science Subject Matter Specialist (SMS). Even in KVKs where the SMS (Animal Science) is available, he/she doesn't have the support to conduct on-farm trials of different technologies in different species of animals. The focus thus remains on training of farmers (mostly on campus) with little impact on skill development.

Dairy cooperatives have been very successful in delivery of all the three services in few states, where the milk procurement is linked to a fleet of vets whose services are accessible to the dairy farmers (24 X7). Of late in many milk unions, these services are not available to the member producers (Chander and Sulaiman, 2014). With deterioration in finances, they are losing their market share to

private agencies. The private milk dairies also focus on milk procurement but not on extension and advisory service (Sangameswaran, 2014).

NGOs such as BAIF have been quite successful in delivery of services (mainly breeding and training) as they maintain a close contact with the livestock owners. Their success is attributed to the dedicated leaders and committed staff, but their impact is restricted to only few pockets.

Integrators, for instance in the "contract poultry farming" have made inroads especially in southern states mainly because of the integration of supply of inputs (chicks, feed, vaccines, extension advisory services, disease diagnosis, vaccinations, deworming, etc.) by the integrators with the labour and facilities provided by the poultry farmers (shed, electricity, water, litter etc). All the three services viz. supply of inputs, extension advisory and technical service are provided by one agency i.e. integrator. The integrator also collects the eggs, and or birds for marketing. The ability of the poultry farmers in rearing chicks with zero mortality is mainly due to the appropriate use of all the above services. At the end of the production period, the farmer is going to get a fixed amount as rearing charges.

Though considered exploitative, the integrated poultry farming is gaining more popularity as the farmers are free from investment, production and marketing risks (Rao *et al.*, 2011). The farmers are taking care of the disease risk as millions of birds are being reared in several locations and the chances of spread of diseases in all the locations is bare minimum when compared to rearing all the birds in one location by the integrator. This also facilitates the easy marketing of the product for the integrators in different locations.

Consequences of Poor Knowledge

With virtually no extension support, livestock owners lack knowledge to deal with a number of challenges they face and as a result they are incurring huge losses. This knowledge poverty is resulting in losses with far reaching consequences for the society.

Public health concerns: Livestock owners usually sell their sick or dead animals to butchers thus contributing to the spread of important zoonotic diseases, such as Anthrax, Brucellosis, TB, Salmonellosis etc. Most of the farmers are not aware that the animal suspected to be died of Anthrax must be disposed off through deep burial. Due to ignorance, the livestock owners either throw the carcass near the river beds or sell or consume the meat leading to serious public health concerns. The carcass should not be even opened as it results in spore formation leading to the exposed area becoming endemic to Anthrax which is of zoonotic importance.

Economic loss to the cattle owners: The dairy farmer has to take the cow in proper heat for better conception through AI and for this he or she must know the symptoms of heat in a cow and skill in identifying a cow in heat. If he takes the cow in early or late heat the chances of conception will be low and he has to wait for another 21 days for the next heat. Similarly, the cow which was inseminated 3 or 4 times and not conceived need to be examined by a Vet. The dairy farmers due to their poor knowledge keep on getting their cows inseminated to check their luck. In the absence of proper extension and advisory service, the dairy farmers will be losing because of the increased dry period (not in milk).

Low adoption of preventive services: Prevention is better than cure. But this is rarely followed. Preventive measures such as deworming and vaccination must be followed regularly to reduce avoidable losses through mortality and morbidity. As the impact or benefits of deworming and vaccination cannot be observed (even in future) by the livestock owners, they do not consider it necessary to know about the deworming and vaccination schedules. Both the livestock owners and vets plunge into action during disease outbreaks. Under normal situation, neither the livestock owners demand such preventive services nor does the DAH proactively deliver such cost effective services. The net result is that most of the animals are not under the protective vaccination umbrella.

Cash input vs non cash inputs: The livestock owners are reluctant to use cash inputs to improve the economy of their farms. The goat owners (resource poor) prefer grazing (non cash input) to feeding with concentrates (cash input) though the former practice requires more time to increase the body weight of the goats. Similarly, the dairy farmers also prefer to allow their animals for grazing to get 2 or 3 litres of milk rather than feeding with concentrates to get more milk, though the latter is economically profitable to practice.

Exploitation by middlemen: The middlemen or brokers exploit the livestock owners whenever the livestock owners are interested to purchase or sell their animals due to their poor knowledge. Majority of the farmers do not know the characteristics they look for while purchasing animals or the market value of the live animal or product they wish to sell. This exploitation could be noticed especially during the implementation of Government schemes, namely, distribution of milch cows, goats, sheep, poultry, etc. In most cases, the purpose for which the animals are distributed (to create livestock assets for improving the livelihoods) is defeated as the

animals are sold before realizing their potential.

Lack of awareness about efficient and transparent marketing methods: The milk producers in most of the dairy co-operative societies know that testing of milk is not done transparently and thus is leading to several malpractices. The Automatic Milk Collection Unit (AMCU) which is a transparent system to assess the value of the milk is not used in many dairy co-operative societies. Unfortunately, majority of the member producers are also not aware that they are the owners of the dairy co-operative societies and their milk union is empowered to establish such AMCUs in the societies.

Ignorance about the negative consequences of technologies: Most often than not, the researchers highlight the advantages (known) of their technologies without explicitly indicating the negative consequences (known or unknown) of adoption of such technologies. The dairy farmers are usually given the information that crossbred cows give more milk than local cows but under what conditions is not revealed to them.

Crossbred animals (cows, goats, sheep, poultry etc) need quality feed and management for better performance. These animals being more susceptible to diseases need better health care. Superior technologies need quality inputs and services. The crossbred cow milk is quite often rejected in the societies as it contains less fat and SNF (Solids Not Fat) than the prescribed standards (Rao *et al.*, 2011).

Poor market information: The livestock owners must know when, where, whom and how to sell (or purchase) their animals or products. When they are ignorant about this vital market information, they may incur losses or gain less profits. They must know the source, availability, prices etc of both inputs and outputs which enable them to take appropriate decisions in purchase of inputs and sale of products. Wherever, the dairy coops are functioning efficiently, the dairy farmers are aware of the milk procurement and feed prices. Similarly, the National Egg Coordination Committee provides regular updates on the prices of eggs and chicken. But in all the other cases the livestock farmers are in dark. Likewise there are several critical areas where accurate, reliable and timely information plays an important role in enabling the farmers to take appropriate decisions leading to better economy of their farms.

Way Forward

1. The three important services, namely, education of farmers (extension advisory), supply of inputs and technical services must

be delivered by one agency as it facilitates better coordination.

2. The extension professionals need to conduct on-farm trials in different farming system locations. They also must keep abreast with the changing scenarios in livestock farming systems which need entirely different extension approaches. For instance, changes are taking place in types of feeding (extensive to intensive; grazing to stall feeding), type of farming (subsistence to commercial); product orientation (layers, broilers or mixed); market structure (co-operative to corporative; public sector to private sector); type of product (raw form to processed to ready to eat) and increasing demand for livestock products.
3. There is nothing like a standard package of practices suitable for all farming locations. It is the responsibility of the extension professionals to identify and advise the livestock owners based on field trials which must be conducted in a systematic way with the active involvement of the livestock owners. This requires adequate staff and appropriate budgetary allocations.
4. The DAH in most states face shortage of both vets and Para-Vets and this needs to be addressed. While giving utmost importance for performing deworming and vaccinations in protecting the livestock wealth, they should

also educate the livestock owners through appropriate extension teaching methods to enhance their knowledge and skills on various aspects of livestock rearing.

5. The Veterinary Council of India (VCI), the apex body to regulate the minimum standards for Veterinary education in the country must assess the needs of the livestock owners, and ways and means to address these needs through appropriate curriculum development.
6. The academic centres (veterinary universities / colleges, ICAR institutes, KVKs, NGOs etc) can play an important role in improving the capacity of the faculty, vets, SMSs etc in conducting on farm trials on different technologies, the result of which form basis for making appropriate recommendations to the livestock owners for wider adoption (in their locations or regions) as well as to the concerned researchers to refine the technologies.
7. It is not enough to highlight the importance of extension in improving the livelihoods of the livestock dependent families. It must be supported with a clear cut policy with concomitant programmes and budgetary allocation. Unless the policy frame work is translated into the programmes of the concerned departments/ institutions, the policy sounds hollow.

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WHY COLLABORATION MATTERS FOR LIVESTOCK DEVELOPMENT?

Livestock sector's growth in India is constrained not due to lack of organizations or programs, but due to inability of organizations to collaborate with each other, argues SVN Rao.

It is a well known fact that every state in India has a number of organizations for the development of the livestock sector. The state Department of Animal Husbandry (DAH), Veterinary Colleges and Universities, Livestock Development Agencies and Milk Unions are the most notable among these. Though the approaches adopted by these organizations are different and there is a variation in availability of resources based on their mandate and the number of schemes each is implementing, the goal of all these organizations is the same and that is about supporting the livestock farmer. However, effective delivery of livestock services is lacking in most cases mainly due to lack of collaboration among the different organizations in the livestock sector.

Effective delivery of Livestock Services

Delivery of livestock services has three components viz.

- Providing technical services to the animals
- Supplying technical inputs and
- Educating the livestock farmers

Providing services to animals involves vaccination, deworming, breeding and disease management services. To do this, the needed technical inputs such as vaccines, medicines, semen, AI guns, syringes and needles etc., have to be supplied. The livestock farmers have no option but to depend on vets or paravets for all the above services and, to some extent, supply of technical inputs. Unfortunately, the third component, educating livestock farmers on various aspects of livestock management, (feeding, vaccination, disease management, breeding etc) is grossly neglected. Many a time supply of inputs and providing services are considered as an extension service ignoring the fact that "education of farmers is the core of livestock extension service" (Box 1).

Effective delivery of livestock services mostly depends on two factors:

- The number of veterinarians and animal health workers and their competence to address the contemporary challenges faced by livestock keepers, and
- Collaboration between Livestock Development Organizations (LDOs) and Veterinary Universities (VUs) is critical for betterment of the livestock sector.

Rajiv Gandhi College of Veterinary and Animal Sciences (RAGACOVAS) Pondicherry, India in collaboration with State Veterinary Universities, State Departments of Animal Husbandry and

Box 1: Delivery of livestock services: A reality check

It is well known that the vets and paravets focus their attention mainly on breeding and health care services that too in large ruminants. The owner of the large ruminants is also more concerned about the breeding and health care aspects as they have direct and immediate impact on the milk production. However, practices like vaccination, deworming, clean milk production, balanced feeding etc., (that have poor observability of results) which indirectly influence the milk production are ignored both by the livestock farmers and the veterinarians. Education aspect of farmers on these improved practices is largely ignored by the vet as it is neither considered as his responsibility nor listed in his job chart.

Small ruminants which are usually reared by the resource poor families, the contribution of which is not more than 20% of their total family income (and that too through sale of animals once or twice in a year), are often neglected by the vets and paravets. The minimum preventive measures like vaccination against two or three important diseases and regular deworming are not performed by the vets and paravets as they consider that the delivery of these services is not worth the effort. The goat/sheep owners being poor in education do not approach the vets for treatment (perceiving it as costly and time consuming) and rather approach butchers to sell the sick animals. Same is the case with pigs which are reared by the poorest of the poor in the society and there is nothing like delivery of services to these animals. Transfer of information on various aspects of management of these animals is almost non-existing.

With respect to back yard poultry neither the owners are worried nor are the vets concerned about the delivery of services as the contribution of back yard poultry to the family income is not more than 5%, which appears negligible to both the service providers and the service receivers. Hence, the mortality and morbidity is very high in small ruminants, pigs and back yard poultry, due to diseases as the bare minimum services such as vaccinations and deworming are never provided except during outbreaks.



Manpower

An analysis of manpower shortage in the 5 southern states of India revealed that there is a severe shortage of veterinarians (40%) and paraveterinarians (20%) in all the departments of AH that is affecting the delivery of services. The situation in veterinary universities/colleges in terms of shortage of faculty is equally bad affecting the quality of teaching.

Capacity

To meet the evolving challenges confronting the livestock sector, both veterinary faculty and field veterinarians need new capacities. The veterinary faculty would need to develop capacities in teaching methodology/extension approaches. Refresher courses in advanced clinical subjects, management of large scale livestock units, large scale marketing of milk and milk

products, animal welfare, public health issues, understanding effects of environmental pollution for livestock, livestock business management etc. The field veterinarians need to develop capacities in utilisation of livestock byproducts, value addition, import and export of livestock products, entrepreneurship, sanitary and phytosanitary standards, addressing fodder crisis and super speciality in clinical subjects. (Rao et al 2008).

Collaboration

About the collaboration between the development agencies and the universities/colleges, lot of scope for improvement exists. Both parties believe strongly that each can complement and support the work of the other. For instance, the universities/colleges expect the DAHs to support them in the following ways:

- Identification of field level problems for research and cases of disease outbreaks
- Support for validation, testing and refinement of technologies
- Sharing of field data and ITKs for R&D and
- Support to field level trials and validation of technologies

Similarly, the DAH expects the veterinary university/colleges to support it in terms of

- Skill upgradation in clinical subjects,
- Continuing veterinary education,
- Research on vaccines for emerging diseases, fodder and feeds, soil mapping for micro/mineral deficiencies
- Genetic mapping and conservation of native breeds and
- Consultancy support from the University on managing large commercial farms.

Box 2: Potential for Win-Win Collaboration

There are several areas for collaboration that can result in "Win-Win" outcomes. For instance, the Disease Investigation Lab under DAH will be having a large number of samples which will be screened at that level. But some samples need advanced equipments and expertise for further investigation which the DAH lacks. On the other hand the Veterinary College will be having few samples (inadequate exposure for students) but it has better equipments and expertise. An effective collaboration for sharing samples and expertise in this would benefit both and thereby contribute to the capacity of the system. Similarly, the DAH can provide its facilities at its farms and facilitate support to field level research of post-graduate students. The Universities/colleges may acknowledge and use their field knowledge by including them in their Research Advisory Councils. Veterinary Universities/Colleges can in turn provide their subject matter specialists for mass contact programmes organized by the DAH (e.g.: vaccination, deworming and fertility campaigns etc.,) and also involve their students to ensure wider coverage of the activity and to provide exposure to them.

Way Forward

Increasing the number of faculty, field veterinarians, paravets and animal health workers and developing mechanisms for continuous upgradation of their capacity merits immediate attention. Considering the interdependence of each other, suitable mechanisms to promote better interaction, knowledge flows and collaboration between the veterinary universities/colleges and the DAH also needs to be institutionalized to improve the delivery of livestock services.

As a follow-up to the regional workshop at Pondicherry, a state-level workshop was organized at Hyderabad in September 2012 with top officials of the state animal husbandry sector in Andhra Pradesh to find potential ways to promote collaboration. Similar exercises in other states can initiate the much needed collaboration that is critical for livestock development.

Some of the practical steps include:

Manpower: Increased intake of students at UG level from 60 to 100; Encouraging private sector in setting up veterinary colleges and lifting the ban (that exists in some states) on recruitment of faculty positions and also field veterinarians (Rao et al 2011).

Capacity Development: Allocating adequate budgetary support for human resource development; establishing an academic staff college for livestock sector and developing partnership for capacity development with technical and management institutions in India and abroad.

Collaboration: Remandate the Directorate of Extension in Veterinary Universities to play a major role in developing collaboration (sharing information and facilitate joint planning) with the DAH; and create a policy working group at the state level comprising the heads of all agencies in the livestock sector to meet at regular intervals to share details of programmes and review collaborative arrangements.



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PRODUCTIVITY ENHANCEMENT OF SRI LANKAN DAIRY FARMERS THROUGH TRAINING

Extension faculty should help students gain sound practical experience so that they become good extension professionals. Extension Majors of University of Peradeniya, Kandy, Sri Lanka recently organized a training on 'Productivity Enhancement of Sri Lankan Dairy Farmers' as part of their course-work. Kumudu Ariyawanse shares this indelible experience!

Sri Lanka has an agriculture-based economy. Integrated crop and livestock production systems have been the backbone of country's economy, which also provides livelihoods to nearly 80% of its rural population. Apart from paddy and plantation crops, the dairy industry has potential to contribute considerably to Sri Lanka's economic development, while playing an important role in alleviating nutritional poverty. However, the progress in expansion of the dairy industry is not as satisfactory as compared to other sub-sectors of agriculture in Sri Lanka.

Aspirations and needs of communities change with the advancement of technology, economic transformation and commercialization. The rural dairy farmers in Sri Lanka do not seem to have benefited from the opportunity of adapting to these changes at an equal pace unlike the other sectors. Therefore, extension and advisory services (EAS) have to play a pivotal role to meet the new challenges by strengthening the capacity of the dairy sector. The public and private EAS needs to deliver a more prominent and effective service to underserved smallholder farmers.

Productivity Enhancement Training (PET) for Dairy Farmers

Realizing this context, the Department of Agricultural Extension of the Faculty of Agriculture, University of Peradeniya, Sri Lanka, conducted a two-day 'Productivity Enhancement Training' program for selected rural dairy farming communities in *Boraluwewa* and *Pannala*, the North Western Province of Sri Lanka. Four final year undergraduate students majoring in Agricultural Extension conducted the program under the guidance of the academic staff and in collaboration with 'Fonterra Brands Lanka Private Limited', a leading dairy firm in the country. Fonterra facilitated the identification and access to the target dairy farmer groups supplying milk to two collecting centers located in the North Western province. Fonterra training and demonstration farm at Pannala is equipped with proper housing units, shed management and animal welfare. This training center can accommodate around 400 farmers for training programmes and workshops. It also serves as a knowledge and technology distribution hub for dairy farmers by contributing towards improving the dairy production and with futuristic production technologies for the dairy farming communities.

Pre-training Activities

Capacity development of trainers

The students and trainers underwent a preparatory workshop. It provided the participants with insights on conducting farmer trainings, adult learning

principles, extension training methodology and dairy technologies. This helped them understand and address the prioritized needs of the dairy farmers with the ultimate goal of enhancing their productivity. In addition, the participants were exposed to the production and use of multimedia extension tools including an instructional video documentary on 'Silage production' depicting a success story of a local dairy farmer, supported by Fonterra.

Exposure visits to Saga University of Japan helped the participants explore new vistas of agricultural development. The productivity enhancement training program also included a visit to the Rural

Immersion Program in Madurai, India.

Design/development of training tools

Designing of training tools was done with the guidance of specialists from the Department of Agricultural Extension, Department of Animal Science of the University of Peradeniya and Fonterra. Guidance on developing training session plans comprising of simplified technical messages with the objective of enhancing the productivity of local small-scale farmers was provided. Other training tools developed included power-point slides, flip charts, live specimens of fodder & pasture and advisory leaflets.

Box 1: Use of participatory tools in training for need assessment

A familiarization visit to the area was initially undertaken to observe the existing situation of the communities. A two-day interactive session conducted using participatory methods such as transect walks and focus group discussions helped the participants identify the training needs of the selected communities. A short questionnaire helped test the level of knowledge levels and the attitude of the dairy farmers towards technology adoption.

Identification of problems and needs was followed by prioritizing the training needs based on four criteria viz. severity of the problem, long-term effect on sustainability of the production system, availability of resources and relevance of training as a solution to the particular issue. The topics selected for the training of four student participants are:

- a) Feeding and Balanced nutrition supply to dairy cattle
- b) Importance of roughage, drinking water and silage production
- c) Record keeping in a dairy farm and d. Dairy animal welfare

Training Programme

After elaborate preparations and a series of rehearsals, the PET program was conducted in two consecutive days covering two topics each. One was conducted in the village community center in remotely located 'Boraluwewa' and the other in Fonterra Training Center, Pannala. About 25 farmers participated at each location.

Each student (trainer) conducted individual sessions of approximately one hour in the presence of the technical experts who helped the trainers to handle difficult questions from the farmers.

My Session

Topic of my session was 'Importance of roughages and drinking water to improve milk production of dairy cattle, and silage production'. The training was divided into three parts:

- Importance of selecting, growing and providing quality fodder to dairy cows
- Importance of plenty of good quality drinking water
- Small scale silage production

An interactive Q&A session was also conducted at the end of the training programme. Farmer questions were answered by specialists from Fonterra and the academic staff from the Faculty of Agriculture, University of Peradeniya.

Farmers also provided suggestions on the improvement of the existing governmental extension services/schemes, which should be incorporated in order to facilitate the development of dairy industry. The support extended by Fonterra for uplifting rural dairy farming was greatly appreciated by the farmers.

Use of multimedia/video as a training tool proved successful, as farmers showed a keen interest in watching and understanding a video on silage production, successfully adopted by a farmer in similar conditions as themselves. This farmer was also present in the audience and shared his experiences which helped in convincing the participant farmers after the training.

A preliminary evaluation at the end of each training session was conducted by collecting feedback and analysis of this feedback revealed that the participants were highly satisfied with the learning from this event.

Lessons Learnt

This PET program enabled the students to gain an enriching experience of methodically disseminating knowledge and technology to rural agricultural communities. This has now enabled them to understand how to overcome challenges and barriers, mix and communicate with local communities, understand the real needs of communities and realize the responsibility of applying their knowledge to uplift the living standards of rural farmers.

The program was evaluated by a panel of

academic staff and resource persons from Fonterra and their feedback has proved to be very useful in understanding and addressing the challenges faced. We are also convinced that this unique experiential learning activity would immensely help us in our future careers as extension agents.

In addition, this was a rare opportunity to bring together the academia, students, public and private sector stakeholders and the local people to contribute for the transformation of 'rural dairy farmer' into an 'empowered, equipped dairy entrepreneur' through capacity building and productivity enhancement.



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INFORMAL EDUCATION NEEDS IN DAIRYING AND LIVESTOCK SECTOR

The formal extension institutions are unable to meet information and skill requirements of a vast segment of dairy and livestock farmers. Thus, there is an urgent need to think of alternate systems of information delivery to meet informal education needs of this target clientele, argue Mahesh Chander and Devesh Thakur

Indian livestock sector has huge opportunities for growth and expansion owing to increased domestic and global demand for livestock products. Milk demand in India is set to touch 200-210 million tons by 2021-2022 (GOI, 2012). Unless full potential of livestock wealth is harnessed, increasing quantity and quality of livestock products would remain a challenge. The per capita availability of milk, meat and eggs remains much lower than the desired levels, especially amidst the huge regional variations in consumption patterns across the country. Milk and meat productivity per animal is still much lower than the world averages. Most of the livestock owners in India lack required information on practices which could enhance livestock productivity and product quality. The latest report based on the situation assessment survey of agricultural households in India suggests that over 90% of the small-scale farmers (owning <2 hectares of land) continue to be isolated from new technologies and guidance of public research institutes (<http://mail.mospi.gov.in/index.php/catalog/157>).

The National Skill Development Council (NSDC) has pointed out several skill gaps and requirements, many of them pertain to extension-based soft skills (NSDC, 2009). The presence of unskilled professionals with inadequate knowledge in dairying is one of the serious constraints with respect to dairy development in India (ASCI, 2015). The problem exists in both the unorganized and organized sectors. In the organized sector, only some dairy cooperatives and a few bigger dairy companies have skilled manpower to limited extent to perform dairy operations. The Tamil Nadu Veterinary and Animal Sciences University (TANUVAS) has identified a total of 173 courses in the areas of livestock, poultry and fisheries sectors for training and skill development (Express News Service, 2013). The courses that range from one week to three months have been identified by TANUVAS in the context of the growing demand for manpower in these industries. However, the existing capacity with TANUVAS and also at other livestock training institutions like veterinary colleges, SAUs etc is not good enough for skilling the huge manpower engaged in the sector.

Lack of information has been cited as the most important factor for dairy product quality vis-a-vis prescribed standards in India (Jagadish, 2013). Formal extension institutions currently seem unable to meet the information and skill requirements of vast segment of dairy workers. Dispersed rural populations; high cost of delivering information in person and a lack of accountability have limited the efficacy of traditional extension systems in India (Cole and Fernando, 2012). This situation demands creation of alternate systems of

information delivery to meet informal education needs of the Indian dairy farmers. Before that we may have to answer following questions?

1. What is the existing situation of information and skills of workers in this sector?
2. What are the priority areas of information requirements in dairying and animal husbandry?
3. What are the possible ways to improve the situation?

Extension Information and Skill Requirements in Dairying and Animal Husbandry

According to NSDC, to participate in organized milk marketing, milk producer is expected to have access to certain basic extension information. These requirements may vary from identifying a loyal consumer locally, to becoming a member of village level cooperative for getting the best prices

for the produce. The grassroots extension workers are found to be lacking essential skills. Dairy personnel working at procurement level have poor extension networking skills for maintaining good relationship with the farmers and milk producers or village cooperatives. In addition, inadequate communication skills, especially in local language because of diversity of dialects, are also observed among them (NSDC, 2009). Similarly, basic quality requirements and ways to maintain hygienic conditions, implementing basic value addition in terms of pre-heating, etc. for minimizing wastage are also needed. Women constitute major proportion of workforce in dairying (Box 1) and they do not possess formal training or skills to manage dairy enterprises. In fact, many of them have a low perception of information needs on dairying. Low level of education and weaker socio-economic status are one of the most common reasons for poor perception about information requirements (Devaki and Senthil kumar 2013).

Box 1: Workforce in dairying and animal husbandry in India

A sizeable proportion (80%) of India's milk production is contributed by small and marginal farmers. Nearly eighty percent of the Indian dairy industry is still unorganized (Jagadish, 2013). 8.47 million people on a yearly basis are employed in dairy sector, out of which 71% are women (ASCI, 2015). There are 800 dairy plants in the country, but only 18% milk is handled by the organized sector. 95 percent of workers in the dairy sector in rural areas are engaged in production-related activities and only one percent are in the processing. Only 1.2% of dairy workers are engaged in processing including manufacturing of different dairy products in both the formal and traditional informal sectors. In urban areas, there is a slight change in workforce engaged in dairying. 31% of the dairy workers in urban areas are engaged in selling of milk and milk products (Staal et. al., 2008). A little over 6% of workers in the dairy sub-sector are engaged in selling of milk and milk products, including both wholesale as well as retail.

The estimated share of persons who have attended some kind of formal training in agriculture is found to be very low at 1.1 per cent at all India level. The proportion of female workers receiving any training in agriculture is even lower (NSSO, 2013). Public extension systems currently seem to be unable to meet information needs and skill requirements of dairy and livestock owners. Of the 40.6% households who received extension assistance, only 11% of the services came from physical government machinery -- extension agents, Krishi Vigyan Kendras (KVKs) and agricultural universities. More farmers depended on other progressive farmers (20%), media including radio, TV, newspaper (19.6%) and private commercial agents (7.4%) (<http://mail.mospi.gov.in/index.php/catalog/157>).

Problems in Prioritizing Livestock based Information Delivery

International Dairy Federation recommends that dairy producers need to have information about good dairy farming practices to support the production and marketing of safe, quality-assured milk and dairy products. These include broad areas of animal nutrition, animal health, animal welfare, milking hygiene and environment. Studies in India (Subashet al, 2015) have also emphasized that information on animal nutrition, animal health, animal welfare, milking hygiene and environment is needed the most by farmers (Box 2). Among these, information about animal healthcare remains a

major concern among livestock rearers. Further, in animal health, information about symptoms and diseases management has been most sought after by farmers as the studies have reported (Phand et al, 2009).

Not surprisingly, the current dairy information delivery remains skewed towards information provision on areas of animal health; feeding and breeding (Ali, 2011) and lays less emphasis on processing and marketing. Whereas, it is now recognized that information on marketing aspects of livestock and products have become increasingly important. Even the women dairy owners have prioritized livestock marketing aspects as their most important information need.

Box 2: Areas of Information needs of livestock and dairy farms

According to FAO and IDF (2011), dairy farmers, as the primary producers in the supply chain, should also be given the opportunity to add value to their product by adopting methods of production that satisfy the demands of processors and customers. They need to adopt Good Dairy Farming Practices in the following broad areas: Animal health, Milking hygiene, Nutrition (feed and water), Animal welfare and Environment. These practices ensure that safe quality milk is produced from healthy animals using management practices that are sustainable from an animal welfare, social, economic and environmental perspective. Subash et al (2015) prioritized informational needs of dairy farmers in Karnal district of Haryana based on the weighted mean score of each subject area. According to the study, most sought after information by the farmers was in the areas of nutrition and feeding, breeding and reproduction, general management, health care management and fodder production respectively.

A. Animal Nutrition

- i. Feeding schedule for milk animals
- ii. Information on mineral mixtures
- iii. Formulation of ration
- iv. Information on calf starter
- v. Complete feed block
- vi. Complete feed for dairy animals
- vii. Bypass nutrient technology
- viii. Colostrum feeding to new born calf

B. Dairy Breeding and Reproduction

- i. Detection of heat
- ii. Time of service
- iii. Pregnancy diagnosis
- iv. Artificial insemination
- v. Selection of milch animals
- vi. High yielding breeds of animals
- vii. Gestation period
- viii. Breeding heifer
- ix. Suitable to the region
- x. Castration of scrub bulls

C. General Livestock Management

- i. Clean milk production
- ii. Care & management of milch animals
- iii. Housing & sanitation management
- iv. Care & management of new born calf
- v. Record keeping
- vi. Milking methods were regarded as important areas

D. Livestock Health Care Management

- i. Vaccination schedule

- ii. Knowledge about diseases
- iii. Control of external parasite
- iv. Deworming practices
- v. Disinfection of shed
- vi. Disposal of dead animals
- vii. Isolation of sick animals

E. Fodder Production

- i. Fodder crops and its cultivation
- ii. Conservation of fodder
- iii. Chaffing fodder
- iv. Making of urea treat straw

Raksha (2014) in her study assessed information needs of the women livestock owners of Jharkhand. In her study, it was found that 100% farm women wanted information on

- i. Credit/subsidy schemes.
- ii. Milk products and their preparation.
- iii. Marketing of milk and milk products.
- iv. Marketing of sheep/goat/pig/poultry.

According to her, all women respondents were always depending on relatives and neighbours for information on livestock matters. Also, cent per cent had never asked any matter related to livestock to any KVK specialist. She also reported that information on the issues like, production and marketing of the livestock products and its value addition is also a very crucial area where information provision and trainings are required by the women.

Limited Role of Formal Livestock Extension Institutions

Major agencies involved in livestock extension information delivery are state animal husbandry departments, dairy co-operatives, input dealers, *Krishi Vigyan Kendras* (KVKs) and Non-Governmental Organizations (Hegde, 2012).

These agencies use different forms of extension information delivery (individual, group and mass contact methods) to the target clientele. Unfortunately, these agencies suffer from one or the other limitation in their livestock extension activities. The state animal husbandry departments are inadequately staffed, poorly budgeted and ill equipped with major emphasis on clinical

healthcare and have little orientation for livestock extension activities (Chander et al, 2010). The activity of dairy co-operatives are restricted to milch cattle of co-operative farmers. Access, satisfaction level and willingness to receive extension information have been found to be low even among dairy co-operative members (Chander and Sulaiman, 2014).

The veterinary pharmaceutical and feed companies are concerned more with their product development and promotion. The activities of KVKs are inclined clearly towards agriculture extension focusing little on livestock extension (Chander et al, 2010). NGOs too, need to improve the professional competence of animal husbandry information providers (Hegde, 2012). Referring to animal husbandry information services in Uttar Pradesh, Ali (2011) reported the services were of average quality due to the paucity of information emanating from organized extension services. He further added that lot needs to be done in the quality, reliability, and timeliness of animal husbandry based information delivery. Mobile based applications can support delivery of information in this context and its potential needs to be exploited fully.

Exploring the Potential of Mobile Phones in Livestock Extension

Mobile based applications in agriculture are also now gaining ground (Box 3). The National Dairy Development Board (NDDB) in 2015 launched one such mobile based application. This application (app) named '*PashuPoshan*' advises farmers about balanced diets for dairy cows and buffaloes (PTI, 2015).

Government of India has also launched two apps for animal husbandry which are available in M Kisan Portal. One of the applications is used for making request for allotment of breeding bull under Animal Husbandry department of government of Sikkim. Similarly, another app is about registration of applicant who wants to obtain assistance under poultry chick and backyard poultry Schemes by animal husbandry department of Himachal Pradesh. Both have been developed by CDAC, Mumbai (<http://mkisan.gov.in/downloadmobileapps.aspx>).

Mobile based applications on agriculture have not been popular yet because of lack of awareness as also farmers are not comfortable to use them (http://www.business-standard.com/article/current-affairs/few-takers-for-mobile-based-applications-for-farmers-in-gujarat-114060800640_1.html).

Box 3: Mobile based Applications in animal husbandry in Africa

iCow is an SMS (text message) and voice-based mobile phone application for small-scale dairy farmers in Kenya. It is designed to run on both low-end and high-end mobile phones. It's something of a virtual veterinary midwife, helping farmers track the oestrus stages of their cows, while giving them valuable tips on cow breeding, animal nutrition, milk production efficiency and gestation. The app prompts farmers on vital days of cows gestation period; helps farmers find the nearest vet and AI providers; collects and stores farmer milk and breeding records and sends farmers best dairy practices. The text messages and voice prompts are sent to customers within the 365-day cow cycle (Forbes, 2011). Another smart-phone based mobile app is Vet Africa designed for farmers and vets in Africa. This has been found to be effective in supporting the diagnosis of cattle diseases in a range of settings in sub-Saharan Africa (CVER, 2015).



Way Forward

1. Strengthening livestock extension through pluralism

Current livestock extension activities are sporadic and irregular in nature. There is definitely a paucity of co-ordination among different stakeholders. Farmer organizations and NGOs have advantages of having more flexible approach and have greater farmer networking. Private livestock based organizations can potentially improve efficiency of service delivery. They could also contribute through corporate social responsibility (CSR) activities (Chander, Thakur and Verma, 2015). The state animal husbandry departments should cater to services aimed at public goods. The universities and research institutions should be able to highlight innovations in extension service delivery mechanisms. All these actors need to work in co-ordination to meet information and skill needs of livestock owners.

2. Farmer assessment in technology generation and transfer

Most of the livestock technologies have poor rate of dissemination. This is because they primarily begin at laboratories and view farm clientele as passive adopters of such technologies. This necessitates the need to incorporate farmer assessment in livestock technologies through on farm trials.

3. Use of Digital Interventions

Government of India has initiated several digital interventions such as virtual KVKs through which they are able to communicate with their large set of registered farmers via three kinds of medium i.e. voice, SMS and email. Livestock owners face several problems which are unforeseen and non-routine in nature such as animals falling ill and disease outbreaks etc. Thus, question answer segment specifically for livestock owners may be added in this futuristic extension delivery mechanism.

4. ICT enabled animal extension workers

Newer ICT tools such as personal digital assistants, mobile applications, information kiosks, and social media tools can be extremely useful in improving access of information to the livestock owners. Initially the first line extension workers and moderately skilled farmers may be trained to use these tools. Mediation through such IT enabled extension workers can help in using the knowledge from expert systems and apps in dairy and husbandry for farmers to boost their livestock output and income. For instance, a

Mobile phone based audio module on scientific calf management developed at ICAR- Indian Veterinary Research Institute, was perceived by the farmers as highly informative, useful, ready to use and handy which covered entire information on calf management. It was also found helpful in increasing the knowledge level of the farmers on calf management.

5. Promote Farmer to Farmer Extension

Farmer to Farmer extension is appropriate for a wide range of target groups, including women, youth, and the poor. It has been used by dairy co-operatives among their members for horizontal dissemination of information (Chander and Sulaiman, 2014). Farmer to Farmer extension can be useful for spread of simple dairy innovations such as mineral mixture feeding and for becoming a member of producer organization etc. It should however not be used for complex, high-risk, technical enterprises and practices, where cost of an error might be very high e.g. treatment of livestock diseases.

6. Focus on Information needs of Women dairy farmers

Mobile telephony offers newer opportunities to reach women farmers and women in male headed farming households (Mittal and Hariharan, 2015). Voice messages as regular reminders on deworming, mineral mixture feeding to pregnant, lactating animals and heifers etc. can improve adherence to these dairy practices by women who most commonly perform livestock management activities.

7. Focus on emerging information needs of dairy producers

Although, information delivery in areas of animal health and production is vital, marketing information in today's market-driven, high-value food economy has become even more important e.g. one of the initial information required in establishing livestock enterprise is knowing about quality animal source market. Also, the owner needs to know about marketing opportunities to run the enterprise profitably such as linking his produce to the market through co-operatives and other organizations. The situation therefore, warrants moving beyond production related information delivery to information on marketing of livestock and livestock products as well.

8. Use of Social Media

Social media has the ability to generate online discussions and interactions on farm based topics. Reports indicate increased use of social media



(Facebook and WhatsApp) by farming community in India. Public extension systems currently have not yet started using these tools for information sharing and feedback on animal husbandry

among the farmers. It is high time that these tools are used to share information which is reliable and authentic as well as demand driven and engaging with the farmer clientele.

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CAN CSR FUNDS STRENGTHEN INDIAN LIVESTOCK SECTOR?

Indian Animal Husbandry Sector is under-resourced. Increased investments from the Corporate Social Responsibility (CSR) funds can improve the performance of this sector, argue Mahesh Chander, Devesh Thakur and Adesh Kumar Verma

Livestock sector can be considered as a future engine of agricultural growth. Unfortunately, low investment and insufficient funding has resulted in underperformance of the sector. Since government funding for several livestock development schemes remains limited (GOI, 2012), new opportunities need to be explored to meet the requirements. To this end, the recent notable development i.e., Companies Act 2013 (CII, 2013; Afsharipour and Rana, 2014) could be one important avenue. This Act makes it mandatory for companies to spend 2 percent of their profit to social development activities. A Corporate Social Responsibility (CSR) activity is defined as any intervention by a company directed towards the community development (NFCG, 2013). CSR endeavours of companies range from livelihood promotion, health, environment, education, rural infrastructure and women's empowerment (Hussain, 2014). Thus, funds available under CSR can be tapped for use in animal husbandry projects through concerted efforts. Furthermore, CSR initiatives can help exploring possibilities of newer and much needed public private partnership in the livestock development.

Despite the fact that India possesses vast livestock resources (512.05 million), besides 729.2 million poultry (GOI, 2014), a sizeable proportion of livestock suffer from poor production and productivity. The average milk productivity, for instance, hovers around 2.5 kg/day for indigenous cows, 4.91 kg/day for buffalo, 6.78 kg/day for crossbred cows and 0.45 kg/day for goat (DAHD&F, 2015). The productivity is thus far less than the average daily yield of cattle in the developed nations. Furthermore, average meat yields in different species remains abysmally low. Meat yield of most species in India is 20-60% lower than that of the world average. Future growth of Indian agriculture lies in paying more attention to livestock sectors as returns on investment are higher in this sector. The contribution of livestock sector to overall agricultural sector is rising over the years. The sector shows high potential for contribution to GDP. Yet, the allocation of funds to this sector is incommensurate with its contribution to agricultural GDP (Box 1).

There is a need for greater resource mobilization from other sources to support the development of animal husbandry in India. Enhancing investments in this sector through CSR funds offers one good opportunity to address this issue. Moreover, the Government of India has already emphasized public-private partnership in livestock extension services (GOI, 2012). The Government has suggested making concerted efforts to tap

Box 1: Public Funding for Animal Husbandry Development

The Animal Husbandry sector receives 12 percent of the total public expenditure on agriculture and allied sector (GOI, 2012), resulting in the underperformance of the sector. Majority of the 29 sub- schemes in animal husbandry through the Eleventh plan could not perform well due to meagre financial outlay (GOI, 2012). Even in the current five-year plan, allocation of budget (Rs. 116.36 billion) to animal husbandry (excluding fisheries) seems to be far less than recommended budget of Rs 31,560 crores by the Twelfth Plan Working Group. The paucity of adequate funds may make it difficult to achieve targeted growth rate of 6% in this sector. Even the current flagship livestock schemes seem to be insufficiently funded by the Central Government. The share of GOI in the National Dairy Plan (NDP) remains less at a meagre 7.8 percent as most of the funding comes as the International Development Association credit. The budgetary allocation for National Livestock Mission too is an insufficient amount (Rs. 28 billion) considering the fact that the allocation is for the entire XII Five Year Plan period (2012-17). Hence, it is clear that government funding to this sector remains limited.

funds available under CSR for implementing animal husbandry projects (GOI, 2015).

Corporate Social Responsibility (CSR)

The concept of Corporate Social Responsibility (CSR) has emerged from philanthropic activities (charities and donations) of corporations. CSR can be defined as continuing commitment by businesses to behave ethically and contribute to the economic development while improving the quality of life of the workforce and their families as well as of the local community and society at large (WBCSD, 2015). A CSR activity is defined as any intervention by a company directed towards community development (NFCG, 2013). CSR in India has gone beyond merely philanthropy and it has more strategic role in the overall organizational development (Gupta and Kaur, 2013). By incorporating CSR in their business portfolio, companies have made significant achievements in areas such as education, healthcare, livelihoods, rural development and urban development (NFCG, 2013).

As per the Indian Companies Act 2013, it is mandatory for certain class of enterprises

to spend 2 percent of their profit to social development activities such as education, health, agriculture, animal husbandry and rural livelihood generation (CII, 2013). The move toward mandatory CSR is driven by the belief that the private sector has to assist the government in furthering economic growth that is inclusive. In fact, India is one of the fewest countries in the world who have chosen to mandatory approach to CSR unlike the west (US and Europe), where emphasis is more on voluntary contribution (Afsharipour and Rana, 2014). CSR benefits corporate organizations too in multiple ways like building image and reputation, enhancing livelihood of communities by incorporating them into their supply chain, building trust among their target communities etc (CII, 2013).

CSR interventions in animal husbandry development in India

Most of the livestock development activities under CSR interventions by corporates involve partnership with NGOs and government bodies. For instance, BAIF is one prominent NGO working for livestock development by fostering partnerships with several corporates across



states of Maharashtra, Madhya Pradesh, Andhra Pradesh, Rajasthan, Gujarat, Karnataka, Bihar and Uttar Pradesh (BAIF, 2015). Such linkages and partnership through CSR activities also help corporates in enhancing the relationship with stakeholders such as customers, regulatory authorities, local communities and NGOs (LojPur and Draskovic, 2013).

Some of the prominent agro-based organisations that have undertaken livestock development as a CSR activity are Nestle, ITC, Chambal Fertilizers, Indian Immunologicals (IIL), Godrej and

Rashtriya Chemicals and Fertilizers. In addition, many other corporates such as Tata Chemicals, Ambuja Cement Foundation, Bharat Petroleum, Raymond India have also involved themselves in the CSR activities focusing on animal husbandry (Box 2). Animal health through animal health camps, animal sterility camps, vaccination and deworming camps are the most common activities organized under CSR interventions. Some of the corporates appreciably have also made efforts on enhancing the capacities of livestock owners.

Box 2: CSR Interventions in Livestock Sector: Experiences

- The responsible business practices of Nestle started in 1962 in Mogha district, Punjab. The company focused on provision of veterinary services, input and training support to dairy farmers leading to improvement in dairying, economic and social development in the region and at the same time brought more profits to the business (IICA, 2011). Nestlé's approach towards CSR seems to be aimed towards creating shared value instead on philanthropy (Sharma and Kiran, 2012).
- Since 1980s, IIL as part of CSR initiatives has been providing free vaccinations to gaushalas and ring vaccinations free of cost to farmers (IIL (2015)). Awareness activities such as zoonoses day celebrations and Rabies-Quit India campaign also form part of CSR activity of IIL.
- Tata Chemicals Society for Rural Development (TCSRSD) started the animal husbandry project in 1994 with the aim to improve the household income through animal health care, breed improvement and green fodder programme.
- In 1997, Raymond India established J.K. Trust Gram Vikas Yojana to improve the quality of life in rural areas through cattle breeding programme (Raymond, 2015).).
- ITC has one of the largest and most effective CSR programs in India (Mukherjee, 2015). It has established 256 cattle development centres, covering more than 10,550 villages, resulting in over 150,000 artificial inseminations, 500,000 vaccinations and a sizeable livestock nutritional support over the period. The CSR interventions of ITC, mostly for milk procurement and processing, benefitted nearly 450,000 farmers (ITC, 2015).
- Godrej Agro vet has initiated Swadheen, a vocational training in animal husbandry and agriculture across 41 rural schools under its Godrej good and green - a CSR program to increase employability skills.
- ACC India has encouraged women to form Self Help Groups for undertaking goat enterprises and backyard poultry production. It has also facilitated the creation of Joint liability group of livestock owners. This enables the farmers for better linkage with banks for receiving loan to purchase cows.
- TCSRSD has focused on training of local youth to work as Para vets or Pashu Palak Mitras in order to provide first aid at the door step. TCSRSD is trying to provide interest-free loans to purchase animals. It also aims to ensure livestock insurance coverage benefitting the farmers as a CSR activity.
- Digital Extension by dissemination of agricultural information through locally produced videos have also been undertaken as a CSR activity (Dr Reddy Foundation, 2014).
- Capacity building of women livestock owners of Alwar district, Rajasthan, has received attention by Tata Trust. The Trust working with an NGO (Heifer International) is able to create dedicated village women livestock entrepreneurs. These women entrepreneurs now sell livestock feed and medicines and provide basic animal health care. This has benefitted them as well as the local livestock owners (The Hindu, 2015).
- Biogas Plant scheme is successfully revived by Bajaj Foundation (the CSR arm of Bajaj Hindustan Company) in the Wardha district of Maharashtra. The scheme is funded by Bajaj foundation, local panchayat and community. The foundation is responsible for technical support such as awareness building, construction, training workshops, and after-care services (NFCG, 2013).

Challenges in using CSR funds in animal husbandry development

The Companies Act 2013 specifies the list of activities under Schedule VII, which can be included by the companies in their CSR policies.

The list of activities, however, seems to be heavily skewed towards health and education. These sectors are already high priority sectors for government funding. Agriculture development per se does not find a mention in the list of activities included in the Companies Act (2013).

Animal Welfare has been grouped with activities like ensuring environmental sustainability, ecological balance, protection of flora and fauna, agroforestry, conservation of natural resources and maintaining quality of soil, air and water, including contribution to the Clean Ganga Fund setup by the Central Government for rejuvenation of river Ganga. However, the Ministry of Corporate Affairs clarified that items enlisted are broad-based and cover a wide range of activities. For instance, capacity building for farmers and training agriculture labour has been covered under voluntary skill livelihood enhancement project activity under the Act. Apparently, CSR activities for animal husbandry under the new Companies Act have received minimal attention as necessary elaborations on the livestock development are currently unavailable. The provisions of the Act allow a company to pursue any single activity listed in Schedule VII such as donations to Prime Minister Relief Fund. To conform to mandatory CSR disclosures under the new CSR Act, companies might waste the funds or siphon them off unless they are fully committed (DNA, 2015).

Even more, dearth of appropriate and effective delivering institutions can be an implementation bottleneck for firms to initiate the CSR activities (Parwez, 2014). One can find sufficient number of NGOs and input supply agencies engaged in providing animal husbandry extension services. Yet, they often lack credibility and linkages. On the other hand, animal husbandry departments are often not keen to avail the services of NGOs mainly due to resources constraints. Lack of clarity on the extension work remains a major issue as even the meagre allocation of funds i.e. 0.4-1% remained unspent by the State Animal Husbandry departments (Chander and Rathod, 2013; Hegde, 2012). Further, meaningful co-ordination between several animal husbandry organisations with dairy organisations and people's organisations remains absent (Hegde, 2012). Due to lack of co-ordination among state animal husbandry departments, dairy cooperatives and NGOs, duplication of livestock development efforts may happen through CSR activities especially in the matter of routine delivery of services by livestock development agencies.

Way Forward

1. Prioritizing CSR activities on animal husbandry

CSR funding can potentially add resources to an otherwise financially neglected animal husbandry sector. Some of the areas that deserve attention are as follows: feed and fodder

research and development, *Gosadhan* and *Gaushala* development, expansion of cold chain infrastructure for milk collection, setting up of abattoirs, small ruminant development, managing government livestock farms, strengthening of extension educational infrastructure as well as increasing the livestock insurance coverage. In some instances, the companies can also provide human resource and expertise, such as in managing Government livestock and poultry farms, formation and functioning of dairy self-help groups, microfinance support for livestock based livelihood activities, value chain development and market linkages.

2. Sensitization of government machinery towards public private partnership through CSR

Much of the CSR interventions in livestock development are delivered through partnerships of corporates and NGOs. The State Agricultural Universities and animal husbandry departments possess large amount of trained technical staff and infrastructure to carry out livestock development activities. CSR gives a good opportunity for these institutions to foster institutional pluralism and public private partnership. However, often government animal husbandry institutions work with hierarchical approach and the institutions are reluctant to accept such innovations. Hence, there is an urgent need to sensitize and create awareness among the authorities about the potential importance and the role of CSR for overall livestock development. This not only improves the delivery of services but also minimizes the chances of redundant activities and red tape.

3. Long term approach for animal husbandry development

Often the private extension efforts are profit oriented and short term. These endeavours are concentrated on big farmers, more accessible regions and specific livestock species to earn maximum effort. Privatization may hamper free flow of information and create more inequalities among livestock owners. Also, eco-friendly and sustainable farming practices are not favored. The same can occur with the CSR interventions as well. The support of veterinary institutions to CSR in livestock development at present is limited to the sporadic delivery of technical services initiated by private agencies. The government veterinary institutions and private companies need to work for long term holistic livestock development through CSR. Most of the

current activities are limited to organizing animal health camps and distribution of free medicines and health additives only.

4. Effective Monitoring and Evaluation of CSR activities

Though some of the past CSR initiatives are commendable, yet one cannot deny the fact that companies also perform these activities to build their reputation as well as business expansion. This may also be the case for NGOs who often seek funds on the basis of credibility and reputation. Therefore, these organisations may misrepresent and exaggerate their CSR efforts. Appropriate independent agency must monitor the funds utilized as well activities performed. Impact analysis of livestock development is a specialized job and often has to

be undertaken after providing sufficient time.

Epilogue

Looking at the bright prospects of livestock sector to further enhance its contribution to National GDP, it is imperative that more funds should flow in this sector. But this seems not likely from the conventional funding sources. The CSR interventions under the Companies Act 2013, therefore, may be seen as one good opportunity to be cashed upon to fund developmental activities in livestock sector. This, however, calls for better coordination among different agencies viz State Departments of Animal Husbandry, cooperatives and NGOs involved in livestock sector to make good use of the available funds. We are of the firm view that the CSR funds can strengthen the livestock sector.

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EXTENSION FOR PROMOTION OF IMPROVED BACKYARD POULTRY

Promotion of improved strains of backyard poultry can potentially improve nutritional status and income of rural communities, if adequate extension support could be provided. However the focus has been more on the provision of subsidies than on the knowledge and skills, opines M Rajalakshmi, SVN Rao and K Natchimuthu.

Poultry Sector, besides providing direct or indirect employment to nearly 3 million people, is a potent tool for subsidiary income generation for many landless and marginal farmers. The sector also provides nutritional security to the rural poor (DAHD, 2011). The rural backyard poultry in India is contributing to about 30% to the national egg production (about 70 billion). Though losing its importance under the impact of commercial and contract poultry farming, modernization and industrialization, poultry farming is prevalent in the rural and tribal areas of the country (Ahlawat, 2013).

The main objective of the extension and advisory services (EAS) is to improve the decision-making capability of the farming community. The quality of decision-making depends upon the quality of information provided through the extension and the way the information is disseminated. Every technology needs certain conditions to show its worth. The weakest link in the promotion of livestock production technologies is poor delivery of technical inputs as well as EAS. The department of animal husbandry have monopoly on these services in all the states.

In association with ICAR, the Department of Animal Husbandry, Dairying and Fisheries (Government of India) has taken up a targeted programme to upgrade the traditional backyard poultry (Box 1). This programme is intended to give a fillip to the rural backyard poultry with an eye on improving the nutritional status and to supplement the income of the rural households. These initiatives resulted in the development and release of improved strains like Vanaraja, Krishibro, Krishilayer, Caribro, Carired, Gramapria, Naked neck broiler, Dwarf broiler, Swarnadhara etc.

These improved strains are currently multiplied and distributed among farmers through several programmes. The ICAR has also taken up initiative in propagating these strains under All India Coordinated Research Projects (AICRPs). The Directorate of Poultry Research Hyderabad, and the Central Avian Research Institute (CARI), Bareilly, are actively involved in these activities. Agricultural and veterinary universities in different states are also engaged in promoting the improved strains of backyard poultry.

While farmers adopting improved strains of backyard poultry need strong EAS support, they are often left in the lurch and there is nothing like EAS and Veterinary health care support for them (Box 2).

The growth of commercial poultry production in the last three decades is phenomenal mainly due to the effective delivery of all inputs and EAS. The

development of commercial poultry is confined to rich entrepreneurs concentrated in few districts. The per capita egg and chicken consumption are very high in urban and semi urban areas compared to rural areas. Although the annual egg production in India has gone up to 70 billion, the per capita

consumption of eggs in rural areas (15 eggs per annum) did not go up mainly because of the low purchasing capacity. Reports showed that the consumption of eggs and chicken was high in families rearing improved backyard poultry strains (Sasidhar, 2009; Athilakshmy and Rao, 2013).

Box 1: Promoting Rural Backyard Poultry

Promoting backyard poultry in rural areas is an activity under the National Livestock Mission, implemented by the Department of Animal Husbandry, Dairying and Fisheries (DAHDF). The Rural Backyard Poultry Development component covers beneficiaries from the BPL families. Chicks reared up to the age (6 to 8 weeks) where they can survive at the farmers' backyard are distributed to the beneficiaries, the cost of ceiling for which is Rs. 50 per chick during the first year. The beneficiary is also provided with a lump sum amount towards cages, night shelter, feeders, etc., for 20 birds (ceiling Rs. 1500/- during the first year). Establishment of mother units are allowed at State Poultry establishments as well as for beneficiaries with a revised Outlay of Mother Unit (fixed/ infrastructure) ceiling at Rs. 1,50,000 and subsidy 40% during the first year (The ceiling and subsidy may be reviewed if required in future). Operational credit-cum-subsidy may be availed under the Central Grower Unit component of Poultry Venture Capital Fund. Only low-input technology birds are propagated, the varieties of which are circulated by the Department from time to time".

Box 2: EAS in the Poultry Sector

There are three types of poultry farming in India:

1. Commercial layer or broiler farming: A large number of birds are maintained under intensive system owned by a single or group of farmers. As the stakes are very high, emphasis is on quality inputs including EAS which are always available on the farm.
2. Contract layer or broiler farming: In this type, the contractor owns lakhs of birds reared by several thousands of small farmers under intensive system in different locations. The contractor provides all the technical inputs and EAS free of cost to these farmers. The farmers are paid for their labour as rearing charges at the end of the production period.
3. Backyard Poultry farming: The farmers maintain few dual purpose birds (both for egg and meat) mostly local/desi under semi-intensive or scavenging system. Being a low-input and low output system, neither the Veterinarian provides nor the farmers demand technical inputs and EAS. These birds are not even protected against the most important Ranikhet disease, which accounts for high mortality of birds in rural areas. The contribution of the BYP to the total family income is not more than 5% which appears negligible to both the service provider and the service receiver (Rao and Natchimuthu, 2012).

Rearing of improved BYP strains has potential to supply much needed animal protein and supplementary income to the rural poultry farmers. These birds are genetically superior in producing more eggs. The birds gain weight quickly and hence need extra care in their management which obviously demand effective EAS (Ahuja and Sen, 2007). KVKs in Northeastern states had good success in popularising improved strains like Vanaraja and Gramapriya (layer). But the success is limited to a few areas and that too depends upon the provision of EAS support.

The practice changes required to rear these strains are discussed in Box 3.

Backyard Poultry in Puducherry

In Puducherry Union Territory, the distribution of Giriraja, an improved dual-purpose strain to the poultry farmers under the centrally sponsored scheme at a subsidised price is an ongoing

programme for the past several years. Surveys conducted in two regions of Puducherry UT (Karaikal and Puducherry) revealed that almost all the poultry farmers who received Giriraja birds either sold or consumed before the birds reached the stage of egg production. Although they were distributed for betterment of the rural people, these birds were either sold or consumed before the birds reached the stage of egg production (Athilakshmi and Rao, 2013).

The Problem

The government departments or NGOs usually distribute 6 to 8 week old chicks of improved strains at 50–75% subsidy to the backyard poultry farmers. Many of these farmers sell these birds in the market for realising short-term benefits and thus compromising on the long-term benefits of eggs for household consumption and sale of adult birds for generating income. The subsidy itself is

considered as a gain by these farmers. Moreover, these farmers are neither given training on rearing of these birds nor provided with extension advice. The distribution of the birds

is seen as an end rather than as a means to improve nutritional status and the source of supplementary income to the rural farmers.

Box 3: From local birds to improved strains: What it means in practice?

In case of local or desi birds the brooding hen

- serves as a natural brooder,

- protects the chicks from predators, and

- induces the chicks to learn feeding on worms, seeds, insects, grains, vegetable waste etc. while scavenging and also drinking water, skill to escape from predators etc. The farmers who practice rearing of local birds need not depend upon other agencies for procurement of chicks (natural brooding and hatching), commercial feed, feeders, waterers etc., hence, this is considered as self-generating system.

When it comes to rearing of improved strains of BYP, the farmers have to acquire knowledge and skills necessary for taking appropriate decisions to exploit their production potential. These include aspects like artificial heating/brooding (readymade or improvised, temperature adjustments), medication (medicines, dosage and route of administration); feeding (completely on chick mash, completely scavenging or both (period of scavenging); watering (readymade waterers or improvised), housing (type of housing, night shelter), Identification of poor growth or weak chicks and their management, regular vaccination (for which diseases and when), control of mortality (reasons for mortality – disease, predator attacks, poor management) post mortem of dead birds for proper diagnosis and control (whether to take the dead birds for post mortem or not, if yes where and how to get it done), weighing the birds at different stages (how to weigh, approximate required weights at different ages), recording of feed consumption and egg production etc. Different poultry farmers need different advice and also the knowledge or skill to practice.

This leads to what is referred to as practice change (Bennett, 1979) which is necessary to rear the improved strains of poultry. How to bring the changes in these practices? EAS should support farmers in taking good decisions related to all these practices, if the farmers have to benefit from this shift to improved strains.



The agencies which distribute these chicks depend on the field veterinarians and para-veterinarians for delivery of EAS and veterinary services. Although they are expected to provide these services, in reality, it does not happen leading to heavy mortality of birds (mostly unreported) inflicting severe losses to the BYP farmers as well as to the national exchequer. Compared to local birds, improved strains (for that matter any improved technology or practice) demand quality EAS and veterinary services for better performance. The improved strains require at least five vaccinations (five visits of a veterinarian) at different ages to protect the birds from Ranikhet, Fowl pox, etc. in addition to deworming and health care services. This is scrupulously followed in the contract and commercial poultry farms but not in BYP.

The institutions which are selling these chicks of improved strains usually have a high demand because these birds with coloured plumage were considered similar to desi birds and fetch better price than broilers. This is partly also due to the increasing health consciousness of the urban consumers who of late have started preferring coloured birds normally reared under traditional system.

Some of the pilot studies have shown that those farmers who purchased (not on subsidy) day-old chicks continue to rear up to the end of egg production period mainly because their family members developed attachment to the chicks and disliked slaughter of these birds for home consumption. In addition they could observe the potential of the birds to produce more number and large-size eggs compared to that of the desi birds.

Action Research

A study was undertaken to assess the impact of rearing Swarnadhara chicks (improved backyard poultry strain) on the rural households of Puducherry. The BYP farmers were provided with timely and reliable EAS to help them take appropriate decisions. The following steps were adopted in the research.

Selection of interested BYP farmers: The investigator (a woman veterinarian) had a series of group meetings in three selected villages with BYP farmers. In rural areas, BYP rearing is the domain of women folk. They were given information on comparison between desi birds and improved birds. The group meetings helped 137 farmers to take a strategic decision on rearing improved birds. Out of these, 65 farmers participated in the on campus training programme on their own cost. The

training methods included direct exposure to different strains of improved breeds, method demonstration on artificial heating (as the improved strains of chicks will be without the brooding hen), litter management, feeding of chick mash etc. Printed literature in local language was also distributed to the trainees as reference material.

Procurement of Swarnadhara chicks: Fifty trainees paid the entire expenditure towards the cost of chicks, transportation and medicines (contrary to the usual practice of getting all the inputs free of cost or on subsidy). The investigator accompanied two group leaders who had an opportunity to see the hatchery and the activities associated with chick production at Bengaluru. The day-old chicks were transported to Puducherry by rail and road and 1863 chicks were distributed to the farmers as per their demand. This exposure enabled the farmers to understand the process of procurement and transportation of chicks to Puducherry. In this process the farmers acquired the skills of taking tactical decisions.

Monitoring the management of chicks: The investigator monitored the development of rearing chicks through personal contacts over phone and weekly visits to the poultry farms. During these visits, advice on various aspects (technology management) which are essential to help them take operational decisions on managing the chicks were provided. This technology management involves operational decisions – day to day activities. Most of these practices are not necessary when the farmers are rearing local chicks. Effective monitoring helped the poultry farmers in getting the right advice at right time necessary to reduce the mortality and improving the efficiency of the birds. The investigator being a veterinarian not only provided the advice (information) but also the technical service (vaccinations, deworming, disease diagnosis, treatment etc.)

Marketing decisions: These birds being dual purpose could be used for both egg and meat production. The sample farmers of the study included those who purchased more number of chicks (ranging from 50 to 200) for sale at the age of 8 to 16 weeks for meat purpose and those who purchased in small numbers (less than 20) for egg production. All the farmers were advised to maintain records of feed consumption, vaccination and deworming mortality, egg production and other cost parameters. These records were checked by the investigator during her weekly visits. Economics of rearing birds for sale was also worked out at different stages to guide the farmers on the appropriate time to sell

the birds in the market, which usually fluctuates depending upon the season and supply of the birds from neighbouring states (Tamil Nadu and Andhra Pradesh).

Impact

Though this research started with 50 households in eight villages, in a span of one year, 97 households spread over 24 villages in Puducherry started rearing Swarnadhara birds. Out of these, 29 households were purchasing chicks in multiples of hundreds. These farmers sold their birds at an average price of Rs. 225 per bird with a range of Rs 150 (8th week) to Rs.450 (40th week). These farmers were purchasing the chicks regularly (once in a month) from Bengaluru and over a period of time their dependency on the investigator was almost negligible.

Thirty-seven households purchased chicks (less than 20) for egg production that too for household consumption. The farmers who purchased chicks for egg production realised the potential of the birds in producing big brown eggs which usually are sold as desi egg in the market for Rs.10 per egg. Only one farmer sold the eggs to her neighbours, whereas the rest either consumed the eggs or gifted to their neighbours and or friends. These households consumed a total of 3,978 eggs produced during 10 months period (August 2014 to May 2015).

Through effective EAS, the poultry farmers acquired the knowledge and skills necessary for rearing the chicks from day one. The farmers are continuously purchasing day old chicks (without any subsidy) and seeking EAS suggestive of the positive and sustainable impact of rearing improved strains of BYP. The entire expenditure on these inputs and services are met by them that too in a place like Puducherry, where the people are tuned for subsidies and freebies.

The egg production and consumption of eggs at household level has gone up among the BYP households. Almost all the farmers used eggs for household consumption confirming thereby that the farmers tend to consume eggs produced in their farms (backyard) rather than purchasing and consuming eggs. Except few, most of the farmers did not slaughter the birds and reared them for egg production.

The spin offs of such initiatives have a major

impact on the diffusion of technology in several villages with more and more BYP farmers started rearing improved strains of poultry. The investigator and the students of veterinary college are providing the EAS including veterinary health care to the BYP farmers who are purchasing these chicks. To sustain the gains and to enlarge the area of operation it is contemplated to train the BYP farmers or SHG leaders or barefoot doctors to provide these services.

Way Forward

Supply of day-old chicks rather than 6- to 8-week old chicks to the interested and trained farmers helps to improve the nutritional status through consumption of eggs in the rural areas. There is no point in wasting resources on subsidies as the BYP farmers are ready to pay for the supply of inputs and services provided supply of inputs and services is regular.

Effective extension and advisory support, is critical for the successful rearing of improved strains of BYP. Hence, it is necessary to ensure the supply of inputs and EAS before embarking on any BYP development programme. The conditions identified as essential for the successful rearing of improved strains are as follows:

1. Selection of interested BYP farmers
2. Regular supply of quality chicks and feed
3. Prompt delivery of inputs (training, vaccines and medicines) and technical services
4. Effective delivery of EAS and proper monitoring of the birds
5. Remunerative market for improved birds (similar to that of desi birds)
6. Sufficient backyard area with good food base for scavenging
7. Capacity and willingness of farmers to purchase and feed chick mash for the first six weeks and
8. Good neighbours (as these birds quite often soil the neighbours' premises with droppings).

The present investigation serves as a guideline for all those involved in promoting BYP for improving the nutritional status and to supplement the income of the rural poor.

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ARE WE GENERATING NEED BASED AND RELEVANT LIVESTOCK TECHNOLOGIES?

Dissemination of improved livestock technologies is important to enhance livestock productivity. But investigating the relevance of these technologies and the process of technology generation is equally or more important argues Prakash kumar Rathod and Mahesh Chander.

Poor productivity as well as the quality of production and products remains a cause of concern in Indian livestock sector (Chander *et al.*, 2010). Various efforts, therefore, are underway to generate and disseminate improved livestock technologies to improve the productivity. However, till date, most of the technologies or processes concerning livestock sector have recorded poor adoption at the field level, which might be due to various factors like attributes of technologies developed, socio-psychological and personal aspects related to users of the technology, availability and quality of support mechanism etc (Box 1). Only a very few studies have focused on the type of research being undertaken in the livestock sector. Many believe that "researchers know better than the farmers and extension personnel" who are considered mostly as clients of research outputs.

Rao et al (1995), pointed out that researchers and extension agencies are often unaware of farmers' priorities. This leads to development and promotion of technologies that are seldom relevant for them. Hence, there is a need to analyse the technologies developed at research institutions as well as the process adopted for technology development by addressing few questions. Are the research institutions generating appropriate technologies? Do we need more farmers' involvement in technology generation? Or is there a missing link among research, extension and farmers?

Status of Livestock/Animal Science Research in India

Public funded research agencies under the National Agricultural Research System (NARS) lead livestock/animal science research in India. The Animal Science Division of Indian Council of Agricultural Research, (ICAR), New Delhi (<http://www.icar.org.in/en/animal-science.htm>) coordinates and monitors research activities in its 19 Research Institutes and their Regional Centres. The Division has two Deemed Universities, seven National/Central Research Institutes, one Bureau, one Directorate, one Project Directorate and six National Research Centres. The Division coordinates seven All India Coordinated Research Projects (AICRPs) and six Network Research Programmes. In addition, four Outreach programmes and three Mega seed projects (poultry, sheep and pig) are also being operated in different parts of the country at different ICAR institutes, State Agricultural / Veterinary Universities/ State Animal Husbandry Departments and Non-Governmental Organizations.

Though the veterinary universities have greatly expanded in number with funding support from

state governments but their research capacity has weakened (Pal *et al.*, 2012) leading to poor interface of research, extension and education. There has been no parallel increase in the number of scientists. This implies inadequate research staff at the universities and increased overhead costs due to the proportionally larger

administrative burden of more institutes. Further, the investments for commodity-wise public Research & Development indicates that crop science has received highest focus followed by livestock, natural resources, fishery-related issues, and forestry related issues in India.

Box 1: India's livestock sector: Some concerns

India boasts largest livestock population (512.05 million) in the world but the productivity is one among the lowest in the world with that of the world average. For instance, the average annual milk yield of Indian cattle is 1172 kg which is only about 50 percent of the global average (FAOSTAT, 2014), and much less than New Zealand (3343 kg), Australia (5600 kg), UK (7101 kg), US (9332 kg) and Israel (10214 kg). Likewise, despite significant increase in livestock production, per capita consumption of milk (69 kg) and meat (3.7 kg) is much lower against corresponding world averages of 85 and 40 kg, respectively (GOI, 2012). The livestock sector in India is solely dependent on small and marginal farmers who are mostly traditional in nature and rarely follow scientifically recommended practices. Most of the livestock producers being small and marginal farmers, their capacity to mobilize resources required to absorb the latest technologies developed by research institutions is limited. Absence of an effective extension machinery and lack of access to institutional finance or inputs is a major constraint in improving productivity by adopting latest technologies (GOI, 2013). Further, only 5 percent of the households access any information on animal husbandry against 40 percent of households accessing information on modern technology for crop farming (GOI, 2005). Moreover, livestock farmers sought information largely from private rather than public sources. Although animal husbandry sector is feminized in India, most of the conventional training and extension programmes are men oriented and do not suit women. The youth in India has to be promoted to take-up livestock farming on commercial basis. All such issues have been great challenges and concerns for Indian livestock sector.

Issues in Livestock Technology Generation

Organizational Mandates and Personal Motives Vs farmer needs

Livestock technologies are generated and developed as per the mandates of the organization or personal motives but apparently not as per the needs and demands of the farmers or their field situations. The research activities that are conducted seem to be based on the review of global literature on livestock research

which might not be relevant to local situations. Further, the professional competency of a scientist is deemed to be governed by the number of research publications produced than the technologies he has transferred effectively (Rathore *et al.*, 2008). Most often, the researchers highlight the advantages of their technologies without explicitly indicating the negative consequences of such technologies (Rao and Natchimuthu, 2015). Such scenario leads to generation and transfer of irrelevant livestock technologies to farmers as depicted in Box 2.



Box 2: Poor diffusion and adoption of Azolla and Urea treatment of straw

Azolla as animal feed

- Experts state that it is an excellent feed, rich in protein, vitamins and other nutrients required by animals
- It is promoted by government agencies, dairy cooperatives, NGOs and KVKs and there are subsidies (financial incentives) to establish Azolla units
- Farmers argue that the practice of cultivating and feeding azolla to animals is not practically feasible and the adoption is built around the subsidies. The animals do not accept *Azolla* as a sole feed and therefore it needs to be mixed with concentrates or jaggery water
- Extension functionaries too concur with the views of farmers and believe that this technology is impractical at the field level. Adoption of azolla as a livestock feed has failed in many of the South Asian countries
- Yet, articles in praise of azolla are piling up, without any horizontal diffusion of this technology among farmers!

Urea treatment of straw

- Experts recommend it as an excellent technology for improving the nutritive value of straw
- Millions spent on research, development & promotion of this technology among farmers across the country, since the 1980's. This goes on even today. Farmers hardly use this technology, even in places where it is intensively promoted by researchers and extension workers
- Farmers find the treatment too technical and cumbersome to follow
- No horizontal diffusion of this technology among farmers
- It is also promoted under government schemes
- Yet, papers are still being published in praise of this technology

Source: Chander, M. 2011 a&b; Tamizhkumaran and Rao, 2012

Varying perceptions on promoted livestock technologies

Rathod and Chander (2015) pointed out that perception of researchers and farmers on the appropriateness and usability of livestock technologies vary significantly. For instance,

farmers have poor favourable opinion on some of the technologies which researchers perceive as important and have recommended for adoption. Rathod and Chander (2014) through a Delphi study in India also depicted that only few of the technologies were field relevant and need based (Table 1).

Table 1: Perception of farmers about few selected livestock technologies

S. no.	Livestock Technology/Innovation	Observations of farmers about the technology
1	Concentrate feeding	<ul style="list-style-type: none"> • Costly at field conditions and hence, small and marginal farmers cannot afford the same. • Feed is perceived as non-palatable by few farmers.
2	Artificial Insemination (AI)	<ul style="list-style-type: none"> • AI has poor conception rate • Higher chance of getting male calf • Calves susceptible to diseases
3	Clean milk production	<ul style="list-style-type: none"> • Impossible to practice at field conditions • Price of milk is based on fat and SNF. So, microbial count or milk quality is not a priority.
4	Milking/milching machines	<ul style="list-style-type: none"> • Not suitable for small dairy herd • Higher cost of machine for small and poor farmers.

Source: Rathod (2015)

Missing links among research, extension and farmers

Research-extension linkages are very important for transferring developed technologies from researchers to the end users. Very often, the livestock related technologies developed or

modified in the research institutes do not reach the end-users for want of efficient and effective extension mechanisms and procedures (GOI 2013). The research and extension experts do not absorb or use feedback from farmers due to passive nature and limited exposure to field realities. The researchers and extensionists generally contact

farmers only for their capacity building and consultation programmes as per the mandates of their organization. Some of the suggestions

of farmers on selected technologies are given in Table 2.

Table 2: Suggestions of farmers about selected livestock technologies

S. no.	Livestock Technology/Innovation	Observations of farmers about the technology
1	Concentrate feeding	<ul style="list-style-type: none"> Locally available inputs/raw materials must be used to prepare concentrates at home and demonstrate the same at field conditions Need to add few components/sweeteners to make concentrate feeds palatable
2	Artificial Insemination	<ul style="list-style-type: none"> Researchers need to study and confirm why there is more chance of getting male calf from AI Research is necessary to improve conception rate of AI
3	Clean milk production	<ul style="list-style-type: none"> Good quality milk having less microbial count must be promoted and such farmers must be given incentives or higher price Fat and SNF should not be continued as sole criteria for pricing but also should include microbial count Simple tests must be developed by scientists so that farmers can test milk at their farm before selling it in the market

Source: Rathod (2015)

Administrative and operational constraints include lack of infrastructure and resources in the process of technology generation. Under varying conditions, the research objectives are modified to fit- in the existing infrastructure and logistic support which ultimately affects the quality of the research and its output/outcome. The budget allocation and expenditure process is perceived to be complicated in majority of the organizations which creates stress on the researchers and extensionists. Under such circumstances, creation of congenial research environment including improving the number and quality of human resource would go a long way towards improving the process of livestock technology generation in India.

The rate of adoption of livestock-related technologies in smallholder crop-livestock systems worldwide is consistently low. In order to resolve this problem, approaches that guarantee effective linkages among researchers, extension workers, decision-makers and farmers, who have a complex knowledge base and widely dispersed expertise are needed. (Francis et al 1997; Conner et al 1998).

Way Forward

Promote field trials

Livestock research must consider realistic advantages and disadvantages of traditional/conventional and modern methods of livestock production based on the field trials. As it is difficult

to have standard package of practices suitable for all farming locations, the extension professionals must identify and advise the livestock owners based on field trials and also communicate the findings to the researchers as well. The feedback mechanism is inherently weak, which needs to be strengthened.

Strengthen linkages

The linkage workshops and brainstorming sessions among multi-stakeholders must be undertaken on priority basis to generate need-based and field relevant technologies (IVRI, 2014).

Include farmers as partners in research and extension

Farmers are no more mere passive recipients of technology. They should be encouraged to share their feedback and also their indigenous technical knowledge and other grassroots level innovations. Their demands and suggestions can help the research system in developing need based and relevant technologies.

Provide Infrastructure, resources and recognition for testing and adaptation of technologies

The research related to field level testing and adaptation of livestock technologies must be promoted and should be given equal importance like any other research in the form of necessary infrastructure and resources. This should also be one of the yardsticks for judging the researchers.

Reorient veterinary education

Orientation of graduate and post-graduate students towards field realities by having more field exposure visits is important to empower them

with the right research orientation and to have appropriate skills for field extension. However, the current curricula provides only very negligible field exposure and this needs to change.

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QUANTITY VS QUALITY: THE GREAT DILEMMA OF LIVESTOCK RESEARCH

Extension is not merely about promoting research based knowledge among farmers. Providing feedback on knowledge use and raising new and relevant research questions are equally important. SVN Rao and K Natchimuthu take a critical look at the contribution of livestock research in India in this blog and suggest a shift in emphasis in livestock research from increasing quantity to improving quality of livestock products.

Livestock Research is considered as an inevitable tool for livestock development. Application of livestock research has demonstrated its impact on increased production of milk, meat and eggs, reduction in losses in livestock production. Many research articles contain the gains accrued through livestock research, but rarely delve into the losses of research application (all scientists have pro-innovation approach). One potential reason is that the negative consequences of research application will be known only after several decades of its wider adoption in the field. This blog focuses on what we paid or lost to gain the advantages from application of livestock research with special focus on breed improvement.

Crossbreeding

Crossbreeding of native livestock with exotic livestock is an accepted technology to improve the genetic potential of livestock and thereby enhancing livestock output. Crossbreeding of cattle has been recommended and vigorously pursued for wider application since 1970s in India. As a consequence we could produce different varieties of crosses in livestock species including poultry. Efforts are still on to stabilize the crosses to produce higher yields and at the same time retain the resistance to diseases which many of our native breeds of livestock possess in abundance. The negative consequences of the crossbreeding which by now are very well discernible include:

- 1. Loss of native germplasm:** This has been noticed in all livestock species. Some breeds are already on the verge of extinction. Realizing this damage to our indigenous breeds, the Indian Government has initiated programmes to conserve threatened breeds which are likely to be lost. A stage has come that we need to search for our native germplasm outside the country (Ongole cattle in Brazil and Murrah buffaloes in Israel). In institutes like National Dairy Research Institute (NDRI) which has been associated with research on crossbreeding of cattle succeeded in developing new breeds like Karan Fries, Karan Swiss at the cost of disappearance of Tharparkar and Sahiwal cows from the institute's farm (Rao et al, 1995).
- 2. Increased dependence on purchased inputs and resultant increase in costs:** Increased production (output) requires increased feed and management (inputs) leading to increased cost of production and many times increased competition for food grains (Humans Vs livestock) which suits to western countries that consume more animal protein than India. Availability of land for production of grains and fodder in addition to grazing of animals is an indispensable factor in sustaining

higher productivity. Land being limited and fixed in nature is already showing its limitation in sustaining livestock production. The dependency of the livestock farmer on researchers, technical personnel and other input providers is increasing with increase in the application of research that focus on increasing production. We converted many of our time tested sustainable farming systems which are “low input and low output” to “high input and high output” systems leading to commercialization of livestock farming and marginalization of small farmers who are finding it difficult to rear their livestock on purchased inputs. Take the case of improved back yard poultry in India (Box 1).

The livestock rearing in the past was based on

crop by-products with minimal purchased inputs like oil cakes and less dependency on veterinary medicines and veterinary services. Although the research has come out with very good vaccines to protect the animals from various infectious diseases, the causative agents are also actively getting mutated posing serious challenges to the researchers. The net result is development of polyvalent vaccines which protects the animals only from those strains incorporated in the vaccine. Foot and mouth disease occurs in cattle, buffaloes, sheep, goats and pigs, and protecting all these species of animals against several strains of FMD virus remains a utopian thinking. By now it is well known that the crossbreds require more attention from the vets compared to our local animals which are far superior in resisting the diseases.

Box 1: Promotion of Backyard Poultry Strains

Improved Backyard Poultry (BYP) strains (Giriraja, Vanaraja, Gramapriya, Swarnadhara, Krishibro, Krishilayer, Caribro, Carired, Naked neck broiler, Dwarf broiler, Krishna J, Namakkal chicken¹, etc) were developed through research for increased production of eggs and meat. These strains have been released and promoted to improve the nutrition and supplementary income of farm households. However there are several issues which remain unaddressed (Rao and Natchimuthu, 2012; Athilakshmy and Rao, 2012). These include:

- No brooding ability and less mothering instinct among improved strains to protect from natural predators which makes the BYP farmers dependent on hatcheries for chick supply continuously.
- Improved strains cannot thrive on scavenging alone and they need feed supplementation to get the expected body weight gain in time and to support the increased egg production.
- BYP may not be suitable in places where farm mechanization is very high (reduces the availability of grain waste), lack or low availability of backyard area for rearing chicks etc. It is ideal in places where there is abundant food base for scavenging.
- Though, most of the farmers are interested to rear day old chicks of improved strain (few chicks), the difficulties in transporting chicks from the production unit, lack of training, poor delivery of vaccination and de-worming services, are the barriers preventing them to adopt this technology.



3. Perceptions on quality: Despite all the advancements in livestock research, the consumers of livestock products still perceive the products of local animals (desi cow milk, desi chicken, desi chicken egg, desi goat meat) superior in terms of taste, minor nutrients and energy and this perception is reflected on their premium prices. With the realization that organic farm products are better than the products obtained by the conventional farming (which uses synthetic fertilizers, pesticides and growth promoters) the researchers have been recommending organic farming, akin to good old traditional Indian farming system which sustained over centuries. Now a stage has come that the consumer does not know what is he consuming and the health conscious people are looking for healthy food, free from chemicals and pesticides.

4. Implications on human health and environment: No doubt the research has

contributed for increased production but with decreased focus on healthy food. "Chickens raised for their flesh (broilers) are fed large amounts of antibiotics and drugs to keep them alive in conditions that would otherwise kill them. The antibiotics/probiotics make chickens grow so large, so fast that they often become crippled under their own weight. This reckless use of antibiotics also makes drugs less effective for treating humans by speeding up the development of drug-resistant bacteria. Because chickens are fed massive amounts of drugs and pesticides, these chemicals are also found in high concentrations in their feces, and this fecal pollution from chicken farms is especially disastrous for the environment (<http://www.peta.org/living/food/top-10-reasons-eat-chickens/>). The scope of recycling or reuse of outputs is becoming narrowed down leading to the issues like pollution of air, water and soil, with high degree of potentiality to generate carcinogens which are difficult to identify.

Box 2: Indiscriminate use of antibiotics in Poultry industry and Antibiotic resistance in human beings

A study conducted by the Centre for Science and Environment (CSE), New Delhi revealed that 40 % of the 70 chicken samples collected from Delhi, Noida, Gurgaon and Ghaziabad contained residues of six commonly used antibiotics - oxytetracycline, chlortetracycline, doxycycline, enrofloxacin, ciprofloxacin and neomycin. The study also revealed that large scale and indiscriminate use of antibiotics in the poultry industry has led to antibiotic resistance in Indians who are falling prey to many ailments that are otherwise curable.

The poultry sector has been growing at around 8 to 10 percent annually and poultry constitutes of more than 50% of all the meat consumed in India. In order to meet the growing demand and competition, poultry breeders resort to the use of antibiotics to make chickens plump quicker and ensure a steady supply (See also <http://cooks.ndtv.com/article/show/do-you-know-your-chicken-403100>). Since there are no restrictions or limits on the use of antibiotics, the poultry industry has been rampantly using them as growth promoters. The residues of these antibiotics are being transmitted to humans on consumption.

In India, there is growing evidence that resistance to fluoroquinolones is rapidly increasing," says Sunita Narain, Director, CSE. Antibiotics are becoming ineffective due to increased resistance and treating fatal diseases like sepsis, pneumonia and tuberculosis (TB) with fluoroquinolones is becoming tough because microbes that cause these diseases are increasingly becoming resistant to fluoroquinolones, says the report. Source: Report from Centre for Science and Environment's (CSE).

(http://www.livemint.com/Politics/zC3RHtP3iEeNLxnJgZXTJK/Antibiotics-critical-to-humans-used-as-growth-promoters-in-p.html?utm_source=copy)

It appears that we are caught in a situation where we have been compromising quality for quantity and it is high time that we do a review of our livestock research and reverse this trend.

Way Forward

1. Livestock research must come out with a position paper on the realistic advantages and disadvantages of traditional/conventional and modern methods of livestock production and its other implications for wider discussion among various stakeholders, including farmers. Wherever, traditional methods of

farming predominate (tribal areas, interior or remote areas, virgin areas, etc), ways should be found to improve these methods, instead of promoting new types of livestock farming. Wherever intensive methods are followed, there is a need to educate the farmers/entrepreneurs on input use and its health and environmental implications and support options that focus on quality livestock production. Indian Council of Agricultural Research (ICAR) may take a lead in developing this position paper and in framing policies on livestock research that focus on quality.

2. Consumers and farmers should be made aware about the different methods of livestock production and their implications so that they could better decide on what they are consuming. For instance, the consumers must know what price they are paying for consuming the low priced broiler chicken. A very small population (health conscious and having high purchasing power) of consumers have started paying premium prices for organic products which are considered comparatively less harmful to human health. This could be one of the reasons for the consumer demand for poultry tapering off in the US, pushing local companies to increasingly depend on exports (Indian Ban on Imports of US Poultry Sparks WTO Dispute, 7 March 2012, <http://www.ictsd.org/bridges>).
3. Organic livestock production: The methods adopted in organic farming ensure the quality of products without chemical residues. Hence, there should be a policy to promote organic or natural farming which preserves the resources for our future generation (sustainability) by reducing the air and water pollution. Fortunately, the demand for organic farm products is increasing with increasing awareness about the negative consequences of the products of modern farming and perceived advantages of organic farming as well as increased purchasing capacity.
4. Initiate new research focusing on quality (again use science or the scientific principles) and develop breeds/strains which are sturdier and fit into the low input traditional livestock farming system.
5. Conservation of threatened breeds of livestock: Realizing the potentiality of the local breeds and negative consequences of crossbreds, the Government of India is encouraging conservation of local breeds with 100 % Central assistance (Annual report 2012-13, DAHD& Fisheries, GOI). This needs to be promoted vigorously by involving farming communities and NGOs.
6. Document and learn from use of Indigenous technical knowledge: It is also equally important to encourage and promote indigenous technical knowledge to enable the livestock farmers to take advantage of the approved practices in prevention and treatment of diseases in animals. The efforts being taken by the National Innovation Foundation (NIF) in documenting, validating, field testing and facilitating product preparations by using local resources are laudable (www.nif.org.in) It is time for us to learn from our mistakes and move forward for the betterment of human welfare.

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ITK IN ANIMAL HUSBANDRY: THE TREASURE THAT DEMANDS OUR ATTENTION

ITK (Indigenous Technical Knowledge) plays an important role in the day-to-day life of rural people. But with every passing day – as we head towards greater modernization – ITK is losing its importance and relevance, getting slowly confined within a small segment of the population. We need to address this issue, argues Sheikh Shubeena.

Indigenous Technical Knowledge (ITK) is the knowledge that an indigenous community holds collectively in their minds, which is then manifested through their practices and beliefs; as well as used by them in day-to-day life while addressing/solving some of their practical problems. This is the knowledge that is accumulated through generations of trial and error by the people. ITK forms an important component of the life of rural people, especially in the farming community. The farming community, in spite of the latest technologies and advancements, still has strong faith in their traditional knowledge. But with the passing of time the younger generation is showing less faith in ITK as scientific methods are far more 'tested and true' in terms of credibility. The beliefs of this generation, along with the modernization effect, have led to a negative impact on ITK and its use. This has, therefore, led to a diminishing of this knowledge from traditional cultures, over which hangs the threat of eventual, permanent loss.

Box 1: Indigenous Technical Knowledge (ITK)

It is a community-based functional knowledge system developed, preserved and refined by generations of people through continuous interaction, observation and experimentation with their surrounding environment (Pushpangadanet. al. 2002). This traditional knowledge is based on the necessities, instinct, observation, trial and error and long experience of the indigenous societies of different regions (Majhi 2008).

Role of ITK in Livestock Rearing

ITK plays a crucial role in both agriculture and livestock rearing in risk prone and poorly developed areas. ITK acts as a first aid or emergency prescription to people who have no immediate access to formal veterinary facilities. Moreover these locally available, home-made preparations make them cost effective and easy to administer. ITK is also a god send for these small and marginal farmers who are not able to afford formal drugs for their animals due to its prohibitive cost. Many people living in rural-urban fringes are giving up livestock rearing due to high risk of animal diseases and the cost of treatment thereafter. ITK provides an edge to these resource-poor farmers in terms of animal rearing. These indigenous practices are considered as a holistic approach to livestock management and are adopted by non-literate cultures. For local communities indigenous knowledge is an inseparable part of their culture and history (Ghosh and Sahoo 2011).With regard to the

principle of adaptability, ITK are time tested and reliable to the farmers using them, and hence adaptable to their local conditions and socially acceptable. There is no threat of side effects, withdrawal effects, or the presence of undesirable residues in livestock products.

Threat to ITK

As the world is moving fast modern and quick-fix approaches appeal to the eye. ITK being slow in bringing relief is losing its importance. Animal rearing patterns are also changing; today's farmers are generally rearing crossbred animals. In this situation ITK is less effective; moreover livestock farmers are also not ready to risk the lives of their costly animals by treating them with indigenous practices.

ITK is slow in bringing the desired effect, and this is further compounded by the vague diagnosis of diseases by farmers themselves, that can then prove life threatening to the animal. Moreover there is decreasing availability of the plants or herbs used in ITK. The tracts of land where these herbs are grown are dwindling due to urbanization and deforestation, leading to the extinction of these valuable resources in time. ITK, once a practice known to every livestock farmer, is fading from the memories of farmers and is now confined to certain old individuals in the communities or to certain migratory tribes of the country. There is continuous uprooting of untapped resources from their native habitats due to social, economic and political factors that can lead to loss of indigenous knowledge (Girach 2007).

The people who still use and practice ITK for the daily needs of their livestock can be counted on one's fingers and the passing of this knowledge to the next generation is stagnant as the younger generation is least interested in knowing and applying these ancient practices.

ITK, an important component of Livestock Rearing for Shepherds

In some of the northern states of India, such as Jammu and Kashmir, and Himachal Pradesh,

livestock herders pasture their animals in the higher reaches of mountainous areas far away from human habitations for certain months of the year and it is then that ITK becomes the savior of the livestock. Shepherds are the mobile treasure houses of ITK who are able to treat and rear livestock in these months wholly by depending on their knowledge of this traditional method. They also discover and re-discover the traditional treatments and modify them on a 'trial and error' basis. These areas are generally inaccessible and the presence of formal veterinary facilities is almost nil. These regions are also rich in the herbs that are the ingredients for self-treatment. Again with the intensive rearing of livestock the migration of livestock is decreasing and remains confined again to certain Bakarwal tribes. Seeing a diminishing trend in the use of ITK efforts are needed to document and preserve these precious resources which can have far more benefits than just relief for animal ailments. Research on these ITK preparations is the need of the hour as harm arising from drug resistance and side effects of formal medicines is increasing.

Need to Document and Preserve ITK

Modern medicine that was once thought to solve all the problems related to human and animal health is presently facing many challenges. Side effects, drug resistance and other problems has raised many questions on its use (Devaki and Mathialagan 2015). There is certainly no doubt that modern medicine has revolutionized medical treatment but it is important to take the traditional healing system along with it. By integrating traditional and modern scientific knowledge an extensive range of new ideas and practices can be generated for the betterment of mankind (Mishra et. al. 2011). But this correlation and integration can only be achieved once documented information about ITK is available.

Documentation of ITK will help to improve the livelihood of ITK holders who are frequently poor and marginalized by society; and it will also contribute towards improving the national economy. There is continuous uprooting of untapped resources from their native habitats



due to social, economic and political factors that can lead to loss of this indigenous knowledge (Girach 2007). The recognition, preservation and protection of traditional knowledge can play a great role in safeguarding biodiversity, intellectual diversity, and environment on the one hand, and will prevent bio-piracy on the other (Jena 2007; Gupta 2008).

Way Forward

ITK is the heritage of any local community that practices it. The use of ITK has decreased and has remained confined to just a small

section of tribals and pastoralists. With growing negligence a part of this treasure is getting buried under the name of modernization. There is an immediate need to recognize the importance of ITK, and serious steps need to be taken for its documentation, preservation, and validation.

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ANTIMICROBIAL RESISTANCE (AMR): A GLOBAL THREAT TO LIVESTOCK AND HUMAN HEALTH

There is a need to enhance understanding and awareness of AMR through effective communication, education and training. Therefore livestock extensionists should focus their efforts in this area. In this blog, Nukala Ramesh, HemaTripathi, RekhaYadav, and BN Tripathi discuss the issue of AMR and how it could be addressed.

Use of antimicrobial drugs in animals is essential for their good health and productivity, which in turn will ensure better food security, food safety and animal welfare. In the recent past there has been growing concern about antimicrobial resistance (AMR), which threatens to reverse these benefits. Resistance, arising in one geographical location or species can easily spread to other geographical locations or spill over into other species, and thus impact both developed and developing countries. The subject of antimicrobial resistance has not received adequate focus and attention in South Asia, including India. Surprisingly, very little is known about the use of antibiotics in animal husbandry. At present AMR is a global concern and immediate attention is called for to address it. Attention has to be focused on optimum use of antimicrobials with regard to the prescribed guidelines and action plans.

Introduction

India's greatest challenge lies in providing adequate, nutritious, healthy and safe food to more than 132 crores of its human population. But this is getting to be a problem due to shrinking land, decreased labour, dwindling natural resources, climate change issues as well as the considerable migration of farming communities to urban areas. Among all these sectors, livestock sector is of utmost important as it can go a long way towards meeting this burgeoning demands. At present there is a huge gap between demand and production of milk, meat and eggs that needs to be tackled in order to meet the needs of an expanding population. In its haste to meet this need the livestock industry is using excessively high amounts of antimicrobial agents in food-producing animals to prevent diseases and achieve the fastest growth in the shortest period (Manna et al. 2006). Food animals are given small doses of antibiotics mixed with their feed to promote growth and prevent disease. This allows farmers to skimp on nutrition and hygiene, thus saving much financially in the short term but causing great harm in the long run to the human race as a whole.

What exactly is the cost to human beings? The heavy reliance on antimicrobials in animal production has resulted in bacterial resistance in humans, especially to many modern antibiotics used in the treatment of life-threatening diseases in humans. This comes about especially when antibiotic residues remain in the final food products (Bahri 2017) that human beings consume. Due to the presence of antibiotic residues in the final food products, consumers are chronically exposed to low levels of antibiotics leading to AMR, which adversely affect human, animal and

plant health systems. Thus, increasing global antimicrobial resistance (AMR) compromises modern human and veterinary medicine and undermines the safety of our food and environment (FAO 2016). These antimicrobial residues also diminish the economic value of

livestock products and lead to export losses for farmers with respect to international trade and consumer confidence, especially in view of global competitive markets in the post-WTO era and imposition of sanitary and phyto-sanitary (SPS) measures.

Box 1: Related terminology

An **antibiotic** is a low molecular substance produced by a microorganism that, at a low concentration, inhibits or kills other microorganisms.

An **antimicrobial** is any substance of natural, semi-synthetic or synthetic origin that kills or inhibits the growth of microorganisms but causes little or no damage to the host.

Antimicrobial resistance is the ability of microbes to grow in the presence of a chemical (drug) that would normally kill them or limit their growth. Antimicrobial resistance is the broader term for resistance in different types of microorganisms and encompasses resistance to anti-bacterial, anti-viral, anti-parasitic and anti-fungal drugs.

The burden of antimicrobial resistance in livestock and food animals has been poorly documented in South Asian countries, including India. Apart from sporadic, small and localized studies on antimicrobial resistance, evidence at the national level is lacking. We do not have a surveillance system that accounts for use and consumption

of antibiotics in the livestock sector, and there are very few regulations governing the use of antibiotics for non-therapeutic purposes in India, neither is there stringent implementation of protocols (Background paper, Inter-Ministerial Review Meeting on Antimicrobial Resistance 2016, MoH&FW).

Box 2: Reasons for using antibiotics in livestock farming

Therapeutic (or curative) use: to cure diseases, prevent death of livestock and restore their production (milk and meat);

Metaphylactic use: to control the spread of infection to healthy animals (in case 10 to 15% of the animals in a group are ill);

Prophylactic use: by administering sub-therapeutic doses of antibiotics to animals via feed or drinking water, when signs and symptoms of infection are absent but suspected, and are likely to develop into an illness in the very short term; and as Growth Promoters to increase the growth rate and productivity of animals (Chandron and Brugere 2014).

Reasons contributing to Antibiotic Residues in Livestock Products

The major reasons for appearance of veterinary antibiotic drug residues in livestock products include: need to achieve high productivity in short duration on farm; failure to notice drug withdrawal period; extra-label (refers to the use of an approved drug in a manner that is not in accordance with the approved label directions) and indiscriminate use; and over-the-counter purchase of antibiotics by livestock owners. Low-quality medicines, wrong prescriptions, and poor infection prevention and control also encourage the development and spread of drug resistance. Lack of enforcement of restrictive legislation on the use of antimicrobials, poor government commitment to address this issue, lack of guidance on withdrawal periods, and consumer awareness about the magnitude of human health hazards associated with antimicrobial residues consumption through meat

and meat products, and poor maintenance of treatment records – are also primary reasons for incidence of antimicrobial residues in meat and meat products (Muhammad et al. 1997; Kaneene and Miller 1997; CAC 2001; Prajwalet al. 2017).

Research Support on use of Antibiotics in Field Conditions

A few studies have been conducted in the field to understand the antibiotics usage pattern in different food animals. Ninety-five percent of poultry farmers from Punjab do not follow the withdrawal period of drugs after cessation of treatment mainly due to their ignorance and habitual practice over the years. Lack of awareness among poultry farmers and farm workers have been identified as one of the major reasons (Lalawnpuia 2015). The poultry farmers in Punjab use antimicrobials for disease treatment and prevention, and for growth promotion. Antimicrobials were often employed during

transportation of broilers or prior to slaughter for stress tolerance (Brower et al. 2017). According to Vasant (2016), 88% of farmers did not know about antibiotic use and its residue in their animals and milk in Krishnagiri (Tamil Nadu) and Kolar (Karnataka) areas. In Telangana, 94.17% of sheep farmers were reportedly using Oxytetracycline with only self-experience. Large chunks of sheep farmers (87.50%) practice over- or under-dosing of drugs without any knowledge, and most of them treat their animals with whatever medicines available by consulting neighbours instead of using medicines prescribed by veterinarians (Ramesh 2017). Pallavi (2017) reported that in Punjab 89, 74.5 and 70 percent of small, medium, and large dairy farms, respectively, administered antibiotics on a veterinarian's prescription, while 8, 16.5 and 22 percent of farms administered antibiotics by farm workers themselves. All three types of farmers were partially aware of a withdrawal period, and dairy farmers in Punjab never discard milk of the treated animals and continue selling those to consumers.

Antibiotic Residues in Livestock Products and Effects on Human Health

Antibiotic residues in livestock products are a potential threat to human health. Traces of antibiotic residues in contaminated foodstuffs can produce direct toxic effects, which are dangerous for consumers. Penicillin can evoke allergic reactions and small amounts of Chloramphenicol can induce a plastic anemia in certain sensitive humans. Some the Fluoroquinolones have many adverse effects, such as carcinogenicity, mutation photosensitization and allergic reaction (Luet al.2008). Sulfonamides can cause side effects, such

as micturition and hematopoietic disorders (Fang 2007). Tetracycline can damage liver and kidneys; it also influences the growth of skeleton, and can cause other side effects (Guet al.2007). Another threat is that the sub-therapeutic doses of antibiotics in food producing animals may induce antimicrobial resistance (AMR) including transfer of R factor. The resistant bacteria from animals may be transferred directly to humans via the food chain. Further, the resistant genes may also be transferred from animal pathogens or commensals to human pathogens (Barton and Hart 2001).

Strategic Interventions on Prevention and Control of Antimicrobial Resistance

In 2015 WHO unveiled a Global Action Plan (GAP) to combat antimicrobial resistance and implemented tripartite collaboration between FAO, OIE and WHO for this. These organizations are now sharing information and collaborating at all levels, on mechanisms to quantify the use of antibiotics in humans and animals. The strategic objectives of GAP include: improving awareness and understanding of antimicrobial resistance through effective communication, education and training; by strengthening the knowledge and evidence base through surveillance and research; by reducing the incidence of infection through effective sanitation, hygiene and infection prevention measures, optimizing the use of antimicrobial medicines in humans and animals; developing the economic case for sustainable investment that takes account of the needs of all countries; and by increased investment in new medicines, diagnostic tools, vaccines and other interventions (WHO 2015).

Box 3: Some important facts and the current scenario

Global consumption of antimicrobials in food animals was estimated as 131,000 tons in 2013, which would become 200,000 tons by 2030. Currently, China is one of the top five users of antibiotics in food production in the world. The projected consumption and percentage increase by 2030 would be highest in China (8200 tons, 59%), followed by the United States (9,476 tons, 22%), Brazil (6,448 tons, 41%), India (2,633 tons, 82%), and Spain (2,202 tons, 6%) (Van Boeckel et al. 2015).

Recommended inclusion levels in poultry and pig diets were 4 ppm for the narrow spectrum and 10 ppm for the broad spectrum antibiotics in the 1950s. Since then these levels have risen 10 to 20 fold (NAAS 2010).

Using the WHO guidelines, India has also developed a roadmap for combatting AMR (in April, 2017), with six strategic priorities. The focus areas of the National Action Plan (NAP-AMR) similarly include: improving the awareness and understanding of AMR through effective communication, education and training; strengthening knowledge and evidence through surveillance; reducing the incidence of infection through effective infection prevention and control; optimizing the use of antimicrobial agents in

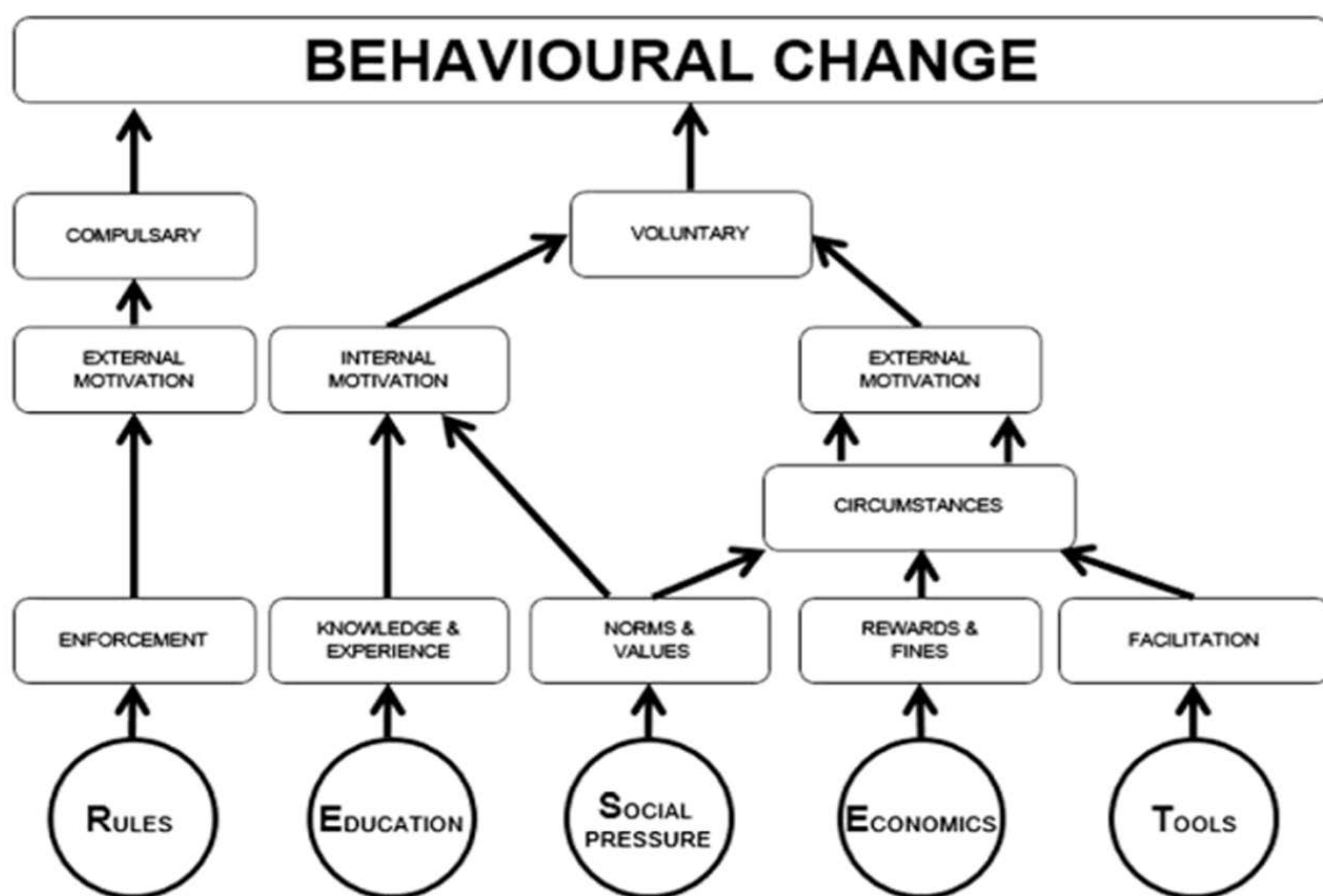
health, animals, and food; promoting investments for AMR activities, research and innovations; and strengthening India's leadership on AMR.

Globally, many organizations such as the World Veterinary Association (WVA) and the World Organisation for Animal Health (OIE) are actively involved in combating AMR by organizing various activities. These include celebrating the 'World Veterinary Day' with the theme Antimicrobial Resistance from Awareness to Action in 2017,

Box 4: Cases of extension intervention

Khatun et al. (2016) conducted a training program at two different locations (Joypurhat and Bogra districts) in Bangladesh on benefits of proper uses of drugs and additives, ways to keep hygienically operating poultry farms and poultry products, disadvantage of excessive drugs in poultry, and the eventual adverse effects of indiscriminate drug use on human health. After imparting the training program, they strengthened technical services provided to the trained farmers, monitored their performance and assessed the impact of this on selected poultry farmers in the next year. Findings revealed that 90-100% of the non-trained farmers and 8-24% of the trained farmers were involved in the indiscriminate use of drugs at respective farms. Further, it was found that 86% of the trained farmers from Joypurhat district and 56% from Bogra district were following drug withdrawal period, respectively. It shows that training and monitoring can play a vital role in changing the existing indiscriminate use of drugs and additives employed by farmers to increase profits.

Lam et al. (2017) used the RESET (Rules & Regulation, Education, Social Pressure, Economic Incentives and Tools) Model (adopted from Woerkum et al. 1999) to change the mindset of dairy farmers and veterinarians towards reduction of antibiotic use in dairy cattle in the Netherlands, and revealed that antibiotic use in dairy cattle decreased significantly. This was made possible by cooperation between the most important stakeholders in the dairy industry, by taking communication seriously, and by applying the RESET Mindset Model.



to create awareness among members of the veterinary community. World Consumer Rights Day 2016 was celebrated under the theme of 'Antibiotics off the menu'. A joint collaborative meeting was held in 2016 between FAO-ICAR to tackle the AMR problem. A Red Line campaign was launched in February 2016 by the Union Ministry of Health and Family Welfare, Govt. of India, to curb irrational use of antibiotics. Recently, the Indian Society of Veterinary Pharmacology and Toxicology organized a national seminar on **Combating Antimicrobial Resistance** and the Food Safety and Standards Authority of India (FSSAI) has issued a draft on **Food Safety and**

Standards (Contaminants, Toxins and Residues) Amendment Regulation-2017, to fix the tolerance limit of antibiotics and pharmacologically active substances in food stuffs of animal origin.

Role of Extension in Combating AMR

In fact, the Global and National Action Plans emphasize the importance of extension services in combating AMR. The first strategic objective of these plans is to improve understanding and awareness of AMR through effective communication, education and training. Veterinary services can play a critical role in building awareness about AMR in livestock production, and

encouraging the prudent use and management of antimicrobials in food producing animals. Though India does not have a separate extension system in the livestock sector the State Departments of Animal Husbandry (SDAH) have well-built networks with livestock owners up to the village level, and they can take primary responsibility to control the indiscriminate use of antibiotics at the field level.

At first instance a campaign should start by creating awareness among masses, on the benefits of proper uses of antibiotics, the adverse effects of indiscriminate use on animal health, and consequences of over-the counter purchase and self-treatment of their animals with antibiotics. SDAH can prepare posters in the local language for display at milk collections points, and veterinary hospitals showing how judicious use of antibiotics and its benefits can help them and their animals. After treating the animal, SDAH personnel need to educate livestock owners on withdrawal periods and its effects. Livestock owners generally do not keep up with follow-up services after administering antibiotics; therefore veterinarians should explain the need and necessity of follow-up services. 'Antibiotics awareness week' should be conducted at the village level at least once per year so that this information gets widely disseminated among farmers. Introduction of AMR as a core component into in-service training programs of SDAH personnel will help them to update their knowledge on AMR, and on latest policies and control methods. Providing basic facilities, such as timely supply of quality medicines to treat animals in addition to diagnostic facilities will help to reduce extra label use of antibiotics. Para-vets and quacks should be adequately taught about the adverse effects of injudicious use, especially of higher generation antibiotics at the very first instance in every case, except in clinical cases. They should not be allowed to treat animals without proper prescriptions from certified veterinarians.

Veterinary universities and KVKs can establish a public communication strategy targeting the community regarding appropriate use of antimicrobials through reading materials, web-based portals and mass media. Education and training on judicious use of antibiotics given to progressive farmers and dairy cooperative members will help to reduce the severity of the problem. These programs should concentrate on reducing the dependency on antibiotics by preventing infection with maintenance of hygienic conditions and good farm management practices, using alternative herbal/homeopathic medicines and herbal feed additives in poultry production, and timely vaccination of animals. KVKs and state veterinary universities should encourage women self-help groups and other farmers who are

involved in livestock-based products, to sell their products as 'antibiotic free' milk or meat to fetch higher prices as compared to the market prices. A general campaign must be initiated to create consciousness among consumers about safe food consumption, withdrawal period of drugs, as well as the ill-effects of drug residues on human health.

Way Forward

- Surveillance data on antibiotic use and information management in animals should be strengthened at the field level.
- There is a need to follow proper treatment protocols in antimicrobial treatment by field veterinarians, as well as by encouraging farmers to strictly follow the withdrawal period.
- The National Action Plan on AMR barely talks about the financial loss accruing to farmers by implementing the withdrawal period. There is need for a special policy to address this issue.
- Our extension programme must focus on creating awareness among livestock owners on judicious use of antimicrobials.
- Focusing attention on the effects of AMR on human and animal health along with creating consumer consciousness are the other major concerns that need to be adequately addressed through educational programmes, by writing about it in blogs, newsletters and mass media, and through ICT tools.
- Farmers must be encouraged to follow Good Farm Management Practices to reduce the incidence of diseases through effective prevention and control mechanisms.
- The State Animal Husbandry Department must allocate adequate human resources, finance and policy guidelines for this operation.
- Controls should be put in place for the purchase of over-the-counter antibiotics by livestock owners from veterinary pharmacy shops/input dealers.
- A multi-sectorial and multi-dimensional approach is needed to address the challenge of the AMR issue. A single organization or discipline cannot solely address this global threat, it calls for the convergence of state animal husbandry departments, NGOs, animal welfare associations and veterinary universities in order to mount a fight on AMR effectively.
- There is a great need to include the topic of AMR in the veterinary curriculum so as to create more awareness among undergraduates.

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BUFFALO CHAMPIONSHIPS AS MOTIVATORS FOR BUFFALO-REARING FARMERS

Considering the importance of buffaloes in Indian agriculture there is an increasing interest in organising buffalo championships in the country. However the quality and effectiveness of these events could be further enhanced argue Sajjan Singh, HemaTripathi, VB Dixit and BN Tripathi.

Agriculture fairs are gaining popularity by the day. Quite often there's more emphasis on crops, horticulture and agro-machinery than on livestock. Currently, there is a growing interest among farmers in diversity of livestock as they provide a steady income to these farmers, even when there is crop failure. Even otherwise animals play an important role in the life of rural communities in India as they are a part of many of their rituals, and are worshiped as well. India hosts some of the largest cattle and livestock fairs in the world, some of these are: the largest cattle fair in India is Bihar's Sonepur Cattle Fair (also known as *HariharKshetraMela*), Nagaur Cattle Fair, Jhalawar Cattle Fair, Pushkar Cattle Fair, Pushkar Camel Fair, Kolayat Cattle Fair, Bateshwar Cattle Fair and Gangapur Cattle Fair. Most of these fairs are organised for the purpose of trading animals, including buffaloes, with no emphasis on competitions.

Now livestock shows/championships are being organized annually by the Punjab Government wherein best buffaloes from all over the country participate. In 2017, the Departments of Animal Husbandry, Fisheries & Dairy Development of Punjab State, along with the Federation of Indian Chambers of Commerce & Industry (FICCI) organized the 10th Agri. & Livestock Expo on December 1-5, at Patiala, Punjab, which turned out to be one of the biggest agriculture and livestock events in the country. This trade fair brought together all the stakeholders of this industry—government (both Central & State), policy makers, industry, research organizations, academicians, farmers, agronomists, NGOs, and Indian and foreign companies associated with the agriculture & livestock sectors – on a single platform to explore business opportunities.

Buffalo Championship

Over the last few years, there has been an increase in the number of cattle shows and championships in India. The prime reasons for organizing these events include: setting new records of milking, identifying best germplasm, and also to serve as a platform for livestock owners to share their problems and discuss potential solutions. During such events farmers also benefit by getting access to new information, along with literature regarding these, from national and international agencies/ companies/ cooperatives/ state departments who also have stalls at these venues.

Considering the importance of buffaloes in Indian agriculture and its contributions to the Indian economy (Box 1), there is an increasing interest in organising buffalo championships in the country. Glittering black beauties attracting crowds in

and around judging pavilions is a common sight in almost all the livestock championships. In the recent past we have seen a succession of championships. The competitions are organized across different categories and species of livestock. While some of the livestock species do not attract farmers in large numbers, buffaloes are emerging as the main crowd puller – both inside

and outside the ring. Buffalo exhibitions are also being organized by governments and some of the institutes demonstrate and showcase quality buffaloes to which farmers are attracted in large numbers. Livestock farmers, especially progressive ones, participate in these exhibitions in order to learn the latest technologies developed by research institutes.

Box 1: Buffaloes and the Indian Economy

Buffaloes are heralded as key contributors to ensuring nutritional security and employment to the rural masses. Asia hosts 97.04% of the total buffalo population across continents. India's contribution to this is 57.8%. India contributes 67.75% of the world's buffalo milk and more than 60% of the buffalo meat, although it is only 36% of the total bovine population. Statistics has revealed the significant role buffaloes play in the Indian economy. At present, buffalo products earn the highest foreign exchange and are the single largest agricultural commodity to generate this sort of revenue for India. The 19th Livestock Census noted that, while the total livestock population (512.05 million in 2012) decreased by about 3.3% over the previous census (18th Livestock Census 2007), the buffalo population recorded growth from – 105.3 million to 108.7 million i.e., about 3.19% (DAHD&F 2010). The female buffalo population is increased by 7.99% over the previous census. The major reason may be that the buffalo is a triple purpose animal, being suitable for milk, meat and as draught animals. It can efficiently utilize poor quality roughage and crop residue into high quality animal produce such as milk and lean meat. Buffalo milk is suitable for a wide range of dairy products including butter, milk powder, mozzarella cheese, khova, curd, yoghurt, shrikhand, dried ice cream mix, dairy whitener, etc., and is the most-liked milk among the masses.

The diversity of buffaloes in India is noteworthy and they are spread over almost all parts of the country with varying population density. India has the world's best buffalo breeds that are noted for their distinct superiority, adaptability to withstand heat, resistance to many tropical diseases, and ability to thrive even under harsh climatic conditions. Buffaloes are the new cash crop for farmers and can be used to double the incomes of their owners. High-milk-yielding buffaloes are redefining farm economics from Punjab, Bihar, and West Bengal to even the south. But it is Haryana that is at the epic centre of this success – for a growing number of farmers in Haryana the real icing on the cake is in raising champion breeding bulls. More than 70% of the milch breeds of buffalo are concentrated in the northern and western states, including Haryana, Punjab, Uttar Pradesh, Rajasthan, Gujarat and Maharashtra, but the population status of 13 recognized breeds varies within the country. In fact these animals are considered an asset financially as they serve as an instrument of insurance against the risk of crop failure due to natural calamities.

National Championships

The Punjab and Haryana governments have been organising National Championships on a regular basis. A few other states have also started following this trend.

Competitions for Adult Bulls

Buffaloes are categorized mainly in to two groups of males and females. Each group is further subdivided into 3-4 categories as per the convenience of organizers. In all, 6-8 competitions, excluding the overall championship of the event, are held. The most attractive show is the congregation of overweight, oversized (specific to breed), overfed and cosmetically prepared and decorated adult bulls, especially groomed for the livestock championships. The major challenge is that farmers are unaware of the genetic merits of these bulls as they are ranked by the judges in the melas on the basis of their phenotypic characters, and the owners exploit this situation by selling their semen at premium prices to innocent farmers who later on feel cheated due

to poor performance of the bulls. Only pedigree-verified bulls with recorded mothers are allowed to participate in the championships and semen from these can be disseminated to the farmers.



Beauty Competitions

The second category is female buffaloes, where the highest milk-yielding buffalo is identified. A sizable number of buffaloes are recorded that yield above 20 litres of milk per day. In this competition, participation is restricted to recorded and registered animals. This event hardly invites controversies, and it encourages farmers to rear quality buffaloes. Competition in other categories is very tough, especially in calf rallies. In these types of competitions only those calves participate who are progenies of tested bulls that have already been used in the field-progeny testing program. Retention or holding of milk for beauty competition is not in the welfare of animals, so it is suggested that routinely milked animals only be selected for competition.

State Championships

State governments also have many programs wherein huge prize money is distributed to encourage the farmers to adopt dairy farming as an enterprise. Many state governments are also organizing calf rallies and milk yield competitions; and give handsome amounts of money to the prize-winning animals. Very recently one mega livestock show was held at Jhajjar during the Golden Jubilee year of Haryana wherein highly lauded animals from all over Haryana and adjoining states participated, and buffaloes were the main attraction of the livestock show. Crores of rupees were spent in organizing this mega event and prizes worth lakhs of rupees were distributed among the breed champion buffaloes as well as to those with the highest milk production records. The state government is also recording the buffaloes at village level by constituting a team of experts. The incentive money is distributed to the owners of recorded animals. The minimum production level from 18 litres of milk upwards is considered for incentive money. This scheme has prompted the farmers to rear quality Murrah buffaloes in the state. This has also improved the quality of germplasm in the state.

Buffalo Competitions Organized by Breeders Associations

Organising *melas* and buffalo championships by breeders' associations is a regular activity and a cost-effective affair because it is arranged on a participatory mode by each participating farmer with no involvement of government machinery. This gives a message to buffalo-owning farmers to rear quality buffaloes, and helps in spreading the message of maintaining superior germplasm. These associations are helpful in registering, conserving, and propagating superior germplasm.

Milk Recordings: An Opportunity to Fetch High Prices for Buffaloes

The state animal husbandry department is making efforts to identify high-yielding Murrah buffaloes at the village level through regular milk recordings carried out at farmers' doorsteps. Murrah buffaloes meeting the benchmark of 18 kg peak yield or 3600kg lactation yields are properly identified (with ear tags) along with their progeny. Cash incentives and certificates issued by organisations enable farmers to get very high prices for their animals. These certified animals also participate in national and state level buffalo championships from time to time, and earn huge prices in cash for their owners. This activity tremendously enhances the price of recorded buffaloes as they are tagged as high yielders during such events. Thus this activity encourages the farmers to rear high-yielding animals.

Calf Rallies- An Opportunity for Farmers to Teach and Learn

Conducting calf rallies provide physical inspection and verification of the calves produced by the field units through Artificial Insemination. It is a great opportunity for livestock owners to learn more about progeny testing, health care, and management practices to get better returns from animal rearing. It not only brings livestock owners from different places onto a single platform and showcases their calves, but also acts as a meeting place for them to see the improved management techniques adopted by other livestock owners. They can also learn how to practically follow innovative feeding methods that can improve the health of their calves as well as how their healthy calves to other farmers. Calf rallies provide an opportunity to get extension advisory services from the scientific personnel at the venue on latest technologies and improved animal husbandry practices, and facilitate farmer-to-farmer extension. Awards and incentives to the calf owners as a token of their participation motivates them to maintain healthy calves so as to get maximum benefits in future. ICAR-CIRB and Haryana Livestock Development Board (HLDB) are a few examples of agencies who implement the progeny-testing program on Murrah buffaloes. They organise calf rallies along with several other extension activities to increase the active participation of farmers.

Way Forward

- The frequency of block and state-level animal shows need to be increased in order to promote quality animals. These livestock shows motivate farmers to rear high-yielding

buffaloes, which in turn will increase their income and enrich the state with valuable germplasm. Organizing these competitions is cost effective because government agencies are already entrusted with the task of organizing these. But they need to increase the frequency of milk recordings and identification of male calves. These animals may be put up for show at village and block level so as to be selected for participation in state and national championships. Competitions may then be held at district and state levels. At state levels, only winners of competitions held at district level may be allowed to participate.

- Judging should be based on set procedures and standards under each category to avoid acrimonious situations during these shows.
- The criteria with weightage should be decided in advance, and made public before the mela. The standard score card for buffalo shows should be followed strictly and animals should be scored accordingly – this makes the judging more objective.
- Ensure proper logistics for owners reaching from distant places with their animals, and arrangements must also be made for fodder and drink for animals.

- Organize buffalo shows and competitions with proper linkages with state departments, veterinary universities, NGOs, associations at regional level for best utilization of resources and efforts.
- During the event technical sessions/interactive sessions may be arranged for intensive discussions.
- Proper arrangements must be made for quarantine to prevent the risk of spreading disease because farmers from across the country bring their cattle, goats, pigs, sheep and other animals to participate, and the status of their health is not known.
- The model followed by Punjab Government for organizing Livestock Shows and Championships for all animal species should also be adopted and replicated by other states, for uplifting the financial status of their farmers.

Although there are certain challenges and threats in organizing buffalo shows and championships but the strengths/benefits outweigh weaknesses. On the whole farmers are greatly motivated and gain much from these events.

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THE YAK-MOVING TREASURE OF HIGH HIMALAYAS

Yak farming is critical for the livelihoods of poor rural nomads in the cold northern areas of Nepal. However, this sector is yet to get the attention it deserves, argues Krishna Acharya

The Himalayan highlands of Nepal are a unique ecosystem. Hardy tribes and various sturdy animal species reside in the harsh terrains that have scanty vegetation. In many places, the land is covered by snow for two-thirds of a year. However, settlements dot the landscape below the tree lines. The people of the high Himalayan region have been rearing animals from time immemorial. The rugged topography, poor precipitation and poor soils make it unfavourable for growing crops. Thus, nomadic pastoralism is critically important for the economy of Mustang District. This makes the yak that can thrive in the arid and cold climate with its poor vegetation a boon for the Himalayan people. They thrive amid the harsh climatic conditions of the high Himalayas with no feed supplementation. Almost every nomad who lives in alpine areas, far away from villages with yaks and chauri, relies solely on the herbal and traditional practices such as shamanic rituals, chants and blessed water as medicine (Acharya et al 2014, Acharya and Kaphle 2015).

Present Situation

Yaks have got special place in the livelihood and economy of Himali people commonly called 'Bhote' and 'Sherpa'. They are the main source of household incomes in the upper slopes of mountain districts of Nepal under the transhuman migratory system (Joshi 1982, Pande 2004). They are a good source of meat and milk. Wool, horns, hide and skin, are the main by-products.

These livestock products have substantial role on household food security of the highland nomadic communities (Acharya 2015). However, the herders are abandoning the yak and chauri farming and are shifting towards other businesses due to lack of adequate pastures, hardship, decreased production and poor animal health services (Pande 2004). The new generation or the youth do not want to be involved in this occupation. They rather prefer other options such as tourism and migration to Middle East or to major cities of Nepal or India (Pande 2007).

Marketing and Value Chain

Regarding the value chain of yak husbandry, the yak herders of Mustang District consume substantial portion of their products. The products mainly meat, milk or butter are consumed either by producers themselves or are shared with relatives living in other districts and overseas. Only the excess of livestock and their products enter the market chain. Marketing of live animals rather than their products at the production points predominates. In lower Mustang, about 200-300 adult yaks are slaughtered annually which is shared by the local communities.

The Yak Farmers Association in Mustang determines the allocation of land for the yak herders. It allows the use of land above the farmer's home at no cost, but association charges some levies when the herders have to use the land of other villages (Degen et al 2007). The live animals are directly sold by the producers without involvement of middleman in this region. Usually yaks above 10 years old are directly sold to those engaged in slaughtering and distribution of yak meat. The animals are slaughtered by traditional method without any regard for food safety.

In some areas such as Rasuwa and Dolakha, milk from chauri (Yak-cattle hybrids) during Baisakh (April/May) to Kartik (Oct/Nov) is purchased by Cheese Production Centers for cheese and butter production (Pande 2007, Chhetri et al 2011). Out of the 28 yak rearing districts, five districts, namely Solukhumbu, Dolkha, Rasuwa, Sindhupalchok and Ramechhap, have cheese factories which produce yak cheese. Most of the Chhurpi (dried cheese) produced is sold to the traders, who visit the herds regularly and export to Kathmandu and India. Ghee produced in the areas are either consumed locally or sold to the traders who export these to the Tibet (Pande 2004).

The herders are only the price takers with no bargaining power who sell their products directly to the traders (negotiators). Thus herders have weak link in the marketing chain. There is a traditional blood drinking ceremony twice a year. In April–May, ceremony takes place at Sekong Lake, Kowang and in Shrawan at Marche (near tukuche) and Mulee (near Kowang). Scores of people gather at the Sekom Lake, Marcheelek, and Mulilek to participate in a blood drinking ceremony. The blood of the yak is supposed to cure gastritis, malaria, purify the blood and enhance sexual vigour.

Yak wool is shorn once a year in June/July and is used to make clothes such as Bakkhu, Docha. Wool obtained from sub adult and adult yak that has poor market value is used to make ropes, tents and carpets (Pande 2007). Wool from the calves of fine quality is used to make warm clothes for humans.

Government and non-government sector namely High Mountain Agribusiness and Livelihood Improvement Project (HIMALI), Department of Livestock Service (DLS), United States Agency for International Development (USAID), and Food and Agriculture Organization (FAO) have made some efforts to promote yak breeding.

Project for Agriculture Commercialization and Trade (PACT) and Department of Livestock Service (DLS) involved in extension and Dairy Development Corporation (DDC) are involved

in marketing of yak cheese. But, initiatives to add value to products such as wool scouring, milk pasteurization have not been taken seriously here in Nepal. Neither the government nor the Mat made from Yak hide with wool NGOs are involved in imparting knowledge to yak herders. As farmers follow the subsistence way of farming, a strong professional extension service is required to transform subsistence farming to market oriented production.

Problems and Challenges of Yak Farming in Nepal

Despite their great potentiality, yak farming in Nepal is currently facing different problems and challenges. These are as follows:

1. Lack of encouragement and motivation to the nomads of remote areas
2. Inadequacy of forage and nutrients during the lean period
3. Inbreeding depression, inefficient selection of animals
4. Climate change and increased incidence of pests and diseases such as Helminthes, myasis, and FMD (Acharya et al, 2014, Shrestha and Prajapati M 2015).
5. Closure of Tibetan alpine pastures to Nepalese herds
6. Low level of research funding available to address the issues of Yak farming
7. Majority of yak herders are illiterate and cannot perform efficiently, scientific observation, record keeping and interpret results.
8. Another major obstacle is the lack of Artificial Insemination service.
9. Absence of veterinary and animal health service to the nomads due to the reluctance of technicians to visit herds
10. Lack of co- ordination among government and other concerned stakeholders.



Box 1: Organizations involved in Development of Yak Farming in Nepal Yak Development farm, Syangboche

This farm was established in 1973 with the introduction of 40 Yaks/Naks from Tibet. Since then the farm produces and distributes 13 breeding animals to the farmers, but the supply is still inadequate. The farmers currently purchase extra stock from Tibet. Apart from this, Yak development farm, Syangboche, Ministry of Agriculture and Co-operatives (MOAC) is working as per their annual programmes for yak development in different districts. Unlike the National Research Center (NRC) on yak in India, research on various aspects of yak husbandry has not taken any momentum in Nepal.

High Mountain Agribusiness and Livelihood Improvement Project (HIMALI)

HIMALI is an agribusiness development project being implemented by Department of Livestock Service (DLS) in 10 mountain districts of Nepal. It aims at agribusiness development, strengthening livestock farms and centres and also value chain development. Currently, in order to strengthen the yak development program in Nepal, HIMALI Project purchased 45 yaks/Naks from Tibetan Autonomous region and handed over to the Yak development farm, Syangboche.

Strengthening extension to promote better use of yak

There is an urgent need to strengthen extension services to support Yak farming. Extension should support farmers in the following aspects:

1. Establishment and promotion of commercial farming at each pocket area of the district
2. Formation of yak user groups @ 10-20 farmers per group
3. Distribution of breeding bull to each of the groups
4. Training yak farmers in modern methods of Yak husbandry

Apart from these, drenching and vaccination programmes for the disease surveillance and monitoring of diseases; formulation and development of policies for economic uplift of the yak herders and establishment of the breeders farm at the regional level (Humla, Jumla, Mustang, and Solukhumbu) are also important.

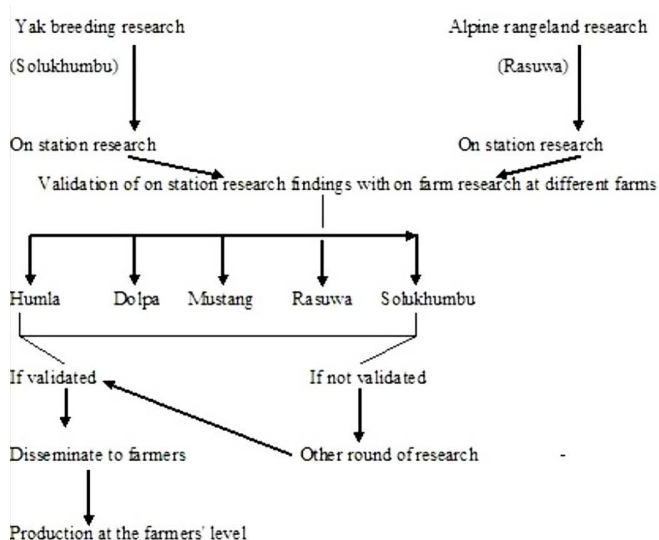


Fig. 1: Recommended research plan for promotion of yak husbandry in Nepal

Sujan Gurung, Yak herder of Kowang who has been rearing yak for 10 years, complained of no support from the government in yak farming. He is following the traditional way of husbandry, which he perceives as partially efficient. Their traditional way of ethno veterinary practices cures most of the diseases with no cost medicines that are collected from their own pastures (Acharya et al, 2014, Acharya and Kaphle 2015). Their indigenous knowledge of husbandry has to be evaluated and strengthened by modern scientific husbandry systems. Sujan perceived the increased incidence of parasitic diseases such as ticks and myiasis in summer pastures and death from extreme cold in winter pastures as compared to the previous year.

Resource constraints for agricultural research

Declining resource allocation for agricultural research and extension is having direct implication on attaining the objective of poverty reduction and food security. The challenge for Nepal Agriculture Research Council (NARC) and Department of Livestock Service (DLS) is to produce as many relevant research outputs to meet the changing needs of Nepalese farmers under increasing resource constraints.

Recommendations

One of the major priorities for development of Yak farming is development of an organized and transparent value chain with all those involved in yak farming, processing and export of yak products and by-products. The following are needed to implement this priority:

- Rangeland and pastureland restoration programmes
- Provision of shelter during the winter months and appropriate feeding, heeding and weeding systems

- Development of niche markets for Yak products both national and internationally
- Well-equipped yak research should be established to develop nucleus herd and replacement stocks along with the other aspects of yak farming
- On farm research on feeding breeding, healthcare, rangeland management and marketing structures in the perspective of Nepalese Himalayas and has to be promoted by strong extension services
- Strong extension services to the farmers for better animal husbandry
- Provision of subsidies to the Yak herders and insurance of Yaks
- Routine vaccination and effective disease management/treatment program.

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