

# CURRENT ISSUES AND FUTURE PROSPECTS OF DAIRY SECTOR IN PAKISTAN

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## Abstract

The aim of this article is to explore the current status of livestock resources, their status of utilisation and the future research concepts in dairy production and milk processing in Pakistan. Advances in the areas of genetics of dairy species, cow reproduction, nutrition, dairy chemistry, milk microbiology, processing technology and milk-based functional foods, have to be applied in Pakistan since the increase in Pakistan's population from 65 to 165 million over the past 3 decades is forecasted to an increase to 234 million by 2025. The need to increase food production means that competition for land and water resources will become more intense. The ecological sustainability of already fragile systems will be further challenged. Agro-industrial byproducts and non-conventional feed resources could be used for feeding of livestock, if farmers are trained accordingly. Situation may be significantly improved if fodder conservation techniques are introduced in livestock feeding systems. Pakistan needs a competitive and profitable dairy farming industry not just for economic but also environmental and social reasons. Productivity potential of local breeds is low and an attempt to genetically improve the local cattle through cross breeding has resulted in improvement in milk yield, acceleration in growth rates and higher prices; however, its discriminate use has been also associated with decreased immunity against temperature changes, disease and nutritional and environmental stresses prevailing in the region. The long-term effects of new systems (such as extended lactations, robot milking and all-year-round housing) will call for ever more intelligent approaches to the simultaneous achievement of quality systems that minimise environmental burdens, sustain high standards of health and welfare and deliver nutritionally valuable products into well organised food supply chains. Value addition, processing, packaging and marketing of milk, meat and eggs, backed up by an authentic quality control system, would improve our products for the people of the country and would provide an export base for national economy. Preparation of the local livestock production system for export to the international *halal* food market must become a national priority to provide *halal* food for Muslim consumers in non-Muslim dominated regions.

**Keywords:** Current issues, Dairy sector, Livestock, Mechanisation, Pakistan.

## Introduction

Agriculture sector, with its important component viz. livestock (animal agriculture), is considered as most vital part of the national economy since the emergence of Pakistan. Agriculture has played a major role in Pakistan's economy as it provides employment to 45% population and also provides inputs for agro-based industry. It provides high quality food for human consumption. Livestock has share of approximately 55.1% of agriculture value added and 11.5% to GDP during 2010-11 (Anonymous,

2010). Current livestock-population of the country includes 31.7 million buffaloes, 35.6 million cattle, 28.1 million sheep, 61.5 million goats and 1 million camels (Anonymous, 2010). Livestock has been appeared as subsistence sector dominated by small holders to fulfill their needs of milk, food and cash income on daily basis. In the rural areas, livestock is considered as a more secure source of income for the small farmer and landless poor people (Hasnain and Usmani, 2006).

Livestock production is the most useful way to improve the income of the landless and the small farmers. They obtain 10-25% of their income through livestock production (Iqbal and Ahmad, 2002). In 2001-2002, about 40% of such income came through livestock products (Anonymous, 2002).

Livestock sector has an important role towards the development of rural economy and its importance may well be recognised from the fact that 35-40 million rural populations are dependent on livestock (Anonymous, 2010). The back-bone of agriculture sector is livestock; though a neglected sector yet still plays an important role in our national economy as it provides, draught power, high biological value animal proteins and its by-products (hides, skin, wool, mohair, bones and manure) (Sarwar et al., 2002). Draught power and manure obtained from animal increase the productivity and fertility of the land that is deficient in organic matter regardless of methane production. More than 10 million heads of draught animals are utilised in agricultural activities. Heavy financial inputs are required for substitution of draught animals. For this purpose, approximately Rs. 5.12 billion are required (Raza, 2000). There is a large variation in geographical and climatic conditions of the country. Pakistan has the advantages of both irrigated plains, containing one of the biggest networks of canals in the world and range areas extended from the coastal ranges in the south to the alpine pastures in the north. In presence of all these factors, development of livestock sector is less as compared to development in agriculture sector that is 2.8% as compared to agriculture's growth rate (5.5%) (Anonymous, 2000), whereas, during 2010-2011, livestock growth was 3.7% as compared to agriculture growth, which is 1.2%. This slow growth of agriculture was due to heavy floods during 2010 (Anonymous, 2010). The major product of dairy sector remained milk and milk production during 2010-2011 (48 million tonnes). In the development of a healthy society, milk plays a vital role and can be used as a tool for development of rural economy, provision of employment and slowing down the migration drift of the rural population. Nearly one third of world's intake of animal protein is provided by milk and milk products (FAO, 1998). In Pakistan, it is not true as milk provides more than half of

the 17.4g of animal protein available for each person daily and so conventional diets give a balancing role to milk.

Needs of milk in population are not being fulfilled by total milk production. The most important cause of this condition is that human population is increasing at faster rate (3 % annually) than the milk production (Bilal et al., 2006). Although, there is an increasing trend in milk production for last several years but cause of this milk production increase is due to increase in total number of milk producing animals and is not due to increase in per head animal production. Pakistan is importing dry milk and products at high cost which is a heavy burden on our economy and imports. There are many causes for low productivity per animal which include low genetic potential of our animals, late age of maturity, poor availability of nutrients, high disease incidence, unorganised marketing system, farming on conventional lines [ (Bilal and Ahmad, 2004) and increased inter-calving intervals. Despite these factors, when comparison of milk with major cash crops was made, it was observed that milk had a value of about 60% higher as compared to both wheat and cotton together (Sarwar et al., 2002) and twice that of sugar cane and rice combined (Bilal and Sajid, 2005), but milk failed to fetch attention as a cash crop.

Development of dairy sector is not only required to meet the increasing demands of animal protein but its development is necessary for social and economic reasons as dairy animals are good source of regular cash income, economically utilise the family labour, produce social security and supply growing markets (Sarwar et al., 2002). Production of milk requires more labour so all members of the family can be utilised for managing dairy animals. In Pakistan, like many other countries of the world, the most useful and efficient way of converting crop residues and agro-industrial byproducts into high quality food is milk production, keeping in mind the potential of Pakistani buffalo.

There are many issues that dairy sector is currently facing. It is the vital need of the time to critically review and resolve the issue of dairy sciences by keeping in mind the previous policies regarding livestock production and requirements

of the increasing population and socio-cultural change.

Feed scarcity, high mortality rate, deterioration of rangelands, lack of value addition facilities, scarcity of sources, inadequate marketing systems, poor extension services and policy constraints are the major issues of the industry, which make this sector under-developed. The main objective of this review article is to address the issues, constraints and future prospects of dairying in Pakistan. This article is focused on two components: the first deals with current issues and problems that the dairy sector is facing and second part deals with recent and future development programmes and needs in the dairy sciences.

### **Issues of the dairy sector**

Characteristics of dairy industry in Pakistan are same like other developing countries, which include small herds, low genetic potential of animals for milk, insufficient marketing channels, lack of technical man-power for dairy industry, high environmental stresses, reproductive and udder abnormalities, poor management practices, lack of commercial feed (Sarwar et al., 2002) and less utilisation of milk replacers. Despite all such problems, dairy animals, mainly buffalo and cattle, are producing 48 million tonnes of milk in Pakistan (Anonymous, 2010). Per capita availability of milk in Pakistan touched 60ml per day (Nazir and Khan, 2009). Although, Pakistan is one of the largest milk producing country in the world but still imports dry milk and other milk products (e.g. butter, cheese, yogurt, cream, whey, etc.) every year to meet the ever increasing requirements for milk and milk products. During 1999-2000, Pakistan utilised approximately Rs. 1213.5 million of valuable foreign exchange on importing milk and milk products (Anonymous, 1999) and during 2005-2006, Pakistan imported dry milk and products worth Rs. 1.1 billion, which is a huge burden on already dwindling our economy (Bilal et al., 2006).

Here, a review is made on the history of cross breeding in the country, the associated benefits and various issues emerging as a result of this intervention.

### **Livestock development projects and their impact**

The previous government started 7 projects in livestock sector having cost of about Rs. 8.8 billion (Anonymous, 2010). The purpose of these projects was to promote milk, meat production and marketing, improve delivery mechanism system to livestock farmers, to provide veterinary services to farmers, prevention of different diseases of livestock and poultry, for improvement of extension services and improving animal quarantine services. A meat development project was started in 2009-2010 in which technical and financial help was given to private farmers and it resulted in 381,678 fattening operations in animals. Recently, 150 milk cooling tanks have been made available in Milk Collection and Dairy Development Programme (Anonymous, 2010).

According to another project “Improving Reproduction Efficiency of Cattle and Buffaloes in Small Holder’s Production System”, Embryo Transfer Technology is carried out at Centre of Excellence for Bovine Genetics at Military Dairy Farms, Okara, and a semen production unit is completed at Renala, Punjab. A European Union funded project “Strengthening of Livestock Services Project (SLSP)” has expanded the disease reporting and epidemiology network from 36 to 64 districts of Pakistan during 2009-2010 by providing IT equipment to disease reporting offices and selective veterinary hospitals in these districts. Establishment of these epidemiological units is carried out at district, provincial and federal level. This project has been established for “National Disease Reporting and Epidemiology System (NDR & ES)”. In the country, during 2009-2010, operational status of 40 regional surveillance units (RSU) and 66 rapid responses teams (RRT) was sustained (Anonymous, 2010).

### **New initiatives**

The future prospect for livestock sector by previous government was to meet MTDf (Medium Term Development Framework) goals for meat (5.0%) and milk (8.0%) production (Anonymous, 2010). It was projected that the achievements would be made by shifting “subsistence livestock farming” to “market-oriented and commercial farming” with a focus on entire market chain. Global *Halal* Food Trade Market has an important role in future. Regulatory measures were also taken by government to improve livestock infrastructure

and allocations in the PSDPs (Public Sector Development Programmes). Other measures for development of dairying in future include allowing import of high yielding animals, semen and embryos for crossbreeding, extension improvement and modernisation of laboratory facilities to diagnose and treat livestock diseases, expanding animal health service, duty free import of veterinary dairy and livestock machinery/equipment, allowing import of feed inputs and vaccines at zero rate (Anonymous, 2010), but there is yet a need to plan a strategy for milk replacers, early calf mortalities and use of probiotics in routine practices.

#### **Imparting technical knowledge and skills focusing on women**

Participation of women in dairy farming in the rural areas is very important in Pakistan as rural women have a key role in managing dairy animals. Most of the organisations developed a programme to improve small holder dairying but failed to achieve their objective due to lack of participation of women in these programmes (Afzal and Naqvi, 2004). Currently, there is a dire need for women participants in their training and skill development programmes. For this, training sessions should be conducted by female trainers. Training should be conducted for calf rearing, raising replacement stock, feeding management, basic sanitation and disease prevention measures.

#### **Organic Farming**

Organic farming has developed as a substitute of traditional livestock farming and is gaining popularity globally. Organic farming provides safe, healthy and secure food. Organic food has high demand due to increased awareness of healthy life style due to which organic farming is getting more attraction worldwide. In Pakistan, Suleiman mountainous region of northeast, hilly and arid terrain of Khyber Pakhtun Khwah and Baluchistan, are well known for organic farming (Raziq, 2009). In organic farming, there is seldom use of synthetic and chemical substances for the wellbeing of livestock and agriculture. In Pakistan, there is an increasing trend toward organic farming.

#### **Issues and Constraints**

Dairy sector has vivid importance and role in national economy but it has failed to attract the attention of policy makers, due to the presence of

high yielding stocks. Dairy sector chiefly functions on non-commercial basis as unorganised sector and as small household farming of 2 to 3 cattle/buffalo and 5 to 6 sheep and goats per family, obtaining 30 to 40% of income from it (Bilal and Ahmad, 2004), while the organised and commercial sector processes only a small quantity of total milk production of the country (Burki et al., 2005).

There are a number of issues that require attention for the development of dairy sector in Pakistan. Some of these issues include improper health services, shortage of vegetation on ranges and insufficient marketing facilities (Jalil et al., 2009). The policies regarding livestock and dairy sector are not always beneficial and the small farmer has never been kept in view during making of these policies. There is a need to establish institution for livestock farmers, where they may either be trained according to the modern changes or their experience can be shared with the urban experts (Hasnain and Usmani, 2006) and currently no institution has been established. There are a number of technical, traditional, marketing and financial constraints to animal production. Some details are as under:

#### **1. Poor availability of nutrients**

The main cause of low milk production of our dairy animals is the poor availability of nutrients in quality as well as quantity (Sarwar et al., 2002). This is major issue for development of dairying. By enhancing the quantity and quality of feeds, livestock production can be improved up to 50% from existing genetic pool of animals (Hasnain, 1983).

In Pakistan, crops, shrubs, grasses and agro-industrial wastes are being utilised to fulfill nutrient requirement of dairy animals. It has been estimated that livestock obtains 51, 38, 3, 6 and 2%, respectively, of their required nutrients from green fodder/crop residues, grazing/rangelands, post harvest grazing, cereal byproducts and oilcakes/meals (Hanjra et al., 1995). In developed countries, where grain feeding is conventional to dairy animal, 75% of nutrients are obtained from forage but in Pakistan, the grain feeding is not common and upto 95% nutrients are obtained through forages (Bulla et al., 1977). The scarcity of feed and fodder in the country is devastating the production potential of dairy animals. This

situation has further worsened due to continuous increase in the population of dairy animals. The genetic potential is not fully exploited.

On the other hand, increase in fodder production is not significant. Low production of forages per acre has further adverse effect on availability of nutrients (Sarwar et al., 2002) and there is no use of silage or concentrates. Estimated amount of total digestible nutrients that are available to livestock is only 75% of the required amount of total digestible nutrient (TDN) while digestible crude protein shortage of digestible nutrient was up to 60% (Akram, 1990). It is reported in Economic Survey of Pakistan, 1999 -2000, that livestock population is increasing at the rate of 1.97% but the area for cultivation of fodder is decreasing. Yet, there is no improvement in condition.

A study conducted by Crowder (1988) revealed that animals in Pakistan are getting 29 and 56.5% deficient nutrients regarding their required TDN and DP, respectively. It is reported that livestock are getting 39.41 and 56.66% less in their TDN and DCP (digestible crude protein) requirements, respectively (Khan et al., 1988). Akram (1990) reported that livestock in Pakistan are 25 and 40% deficient in required amount of TDN and DCP, respectively (Akram, 1990). Hanjra et al. (1995) estimated that approximately 63.2 MT (million tonnes) of TDN and 5.53 MT of DCP is required. Only then a dairy animal can maintain its best production potential. Gill (1998) estimated that 61 MT of TDN and 11 MT of DCP are required for livestock in Pakistan and noted a deficiency of 24 MT and 4 MT for TDN and DCP, respectively. Sarwar et al. (2002) reported that 10.92 and 90.36 MT of CP and TDN, respectively, are required for livestock annually in Pakistan. However, respective availability of these nutrients is only 6.7 and 69.00 MT, which indicates a deficiency of 4.22 and 21.36 MT of CP and TDN, respectively, per year (Sarwar et al., 2002). It is indicated from study that animals are getting only their maintenance requirements. This is a reason that animals are not achieving and exploiting their best production. The dire need of time is to decrease the gap between nutrients availability and nutrients requirements of animals by exploring the available feed resources and improving digestibility. It is needed to carry out proper fodder research and extension

policies regarding better quality seeds, seed growing rate, improved agronomic procedures and improved inputs (fertilisers, water and pesticides). Gap between requirement and availability of nutrients can then be minimised (Sarwar et al., 2002). There is a hesitation in dairy farmers to consume agro-industrial byproducts or non-conventional feed resources to improve livestock feeding. This could be attributed to lack of knowledge about the usefulness of such materials and strict adherence to conventional feeding (Sarwar et al., 2002). We have to improve extension services to convince the farmer for adaptation of new non-conventional livestock feeding, such as, use of silage, urea and poultry litter (as a source of NPN). This could help a lot to minimise the gap between protein availability and protein requirements of ruminants (Sarwar et al., 2002). Agro-industrial by products and non-conventional feed resources could be used for feeding of livestock, if farmers are trained to do so. The farmers are still adopting the conventional system of fodder production with a limited number of fodder varieties that creates periods of abundance and serious scarcities. There is acute shortage of green fodders especially during winter months and there is improper or scarcity of dissemination of skill and information. It may be further helpful in decreasing the gap between requirement and availability of nutrients round the year, fodder is available by introducing year round fodder system and fodder conservation techniques (Sarwar et al., 2002). Farmer should grow fodder varieties that produce fodder round the year or practice rotational crop production and growing of mixtures of other non-conventional fodders like turnips, carrots and wild peas.

Cattle feed industry should be established to provide quality dairy mixes to the farmers at low rates. As compared to poultry, processed feeds are less available for large animals (Hasnain and Usmani, 2006). This indicates that most of the several agro-industrial byproducts and non-conventional feed resources available in the country are wasted. This also increases the feeding cost and more provision of nutrient licks/blocks.

## **2. Deterioration of range lands**

In resource management, ranges have vital contribution. Rangelands are 63% of the total area of Pakistan (Sarwar et al., 2002). Rangelands are

important nutrient reservoir and prevalent at mountain beds. It is estimated that ranges have 38% contribution in feed resources for livestock in Pakistan which is second major contribution after fodder-crop residues, which has 51% contribution (Sarwar et al., 2002). The most economical way to consume rangeland vegetation is grazing but no attention is focused on maintenance of these ranges and drip irrigation and water sprinkling in deserted areas. It is a need of time to conserve these ranges by different strategies, like, artificial reseeding, introduction of competitive and ecological friendly exotic species, water conservation procedures, extension services regarding rangeland conservation and by proper research work. This can provide quality biomass in large quantity from these ranges (Sarwar et al., 2002) or waste lands.

One of the major causes of the low productivity of our animals is the poor grazing condition of these rangelands. Now, they are deficient in nutrients and overgrazed; deforestation and uprooting of the range vegetation is occurring rapidly (Raziq et al., 2010). Rangelands are undergoing deterioration but yet no proper strategies have been made to maintain and improve their productivity. For improvement of rangelands, limited research is conducted traditionally. This condition is worse in Baluchistan province and there is no research facility on conservation of ranges in the province (Raziq et al., 2010). Rangelands come under Forestry Department and there is no coordination between the Livestock and Dairy Development Department and Forestry Department to improve the condition of ranges. If some policies are constituted by both of these departments for the rangelands improvement, then problems of livestock issues can be addressed.

### 3. Animal health issues

Maintaining animal's health is the basic requirement to prevent retarded production from animals. There are numbers of veterinary hospitals and dispensaries throughout the country yet their benefits do not trickle down to the farmers. The animals are actually vaccinated every year but this may not be more than 10% of the livestock population (Iqbal and Ahmad, 2002). Regular vaccinations programme against diseases (e.g. foot and mouth diseases) which affects on production, is not carried out (Sarwar

et al., 2002). There is a need to establish compulsory vaccination laws.

There are several epidemics responsible for high mortality and morbidity in livestock but are not effectively tackled. Most important diseases of livestock, that are endemic in Pakistan, are foot and mouth disease (FMD), hemorrhagic septicemia (HS), black quarter (BQ), rinder pest in cattle and sheep pox, anthrax and enterotoxaemia in sheep and goat (Iqbal and Ahmad, 2002). In cattle, these diseases cause heavy economic losses by causing mortality, decreased production, expenditure on treatment of diseases and sometimes head losses but mastitis is properly treated (Nazir and Khan, 2009).

Sarwar et al. (2002) reported that parasites, especially, internal parasites, usually did not cause mortality but produced high production losses by greatly lowering the overall production of dairy animal. They cause severe parasitic gastro-enteritis and blood protozoans. Poor husbandry practices and lack of awareness of the farmers about the common control measures further complicate the parasitic problems like tick control and vector borne diseases (Sarwar et al., 2002). The economic losses by these diseases have been estimated to be Rs. 79 billion that is approximately equivalent one billion US\$ alone in the Punjab and economic losses due to various livestock diseases were estimated to be Rs. 8.4 million per district per annum in the province of Punjab by dairy farmers and others (Nazir and Khan, 2009). These losses can be prevented and minimised by providing community-based health delivery services through the community-based animal health workers (Nazir and Khan, 2009). These workers should work under the supervision of graduate veterinarian or under an integrated network.

Community based veterinary service delivery systems have been introduced in many countries of the world, where there has been a lack of veterinary services. These types of veterinary services are affordable by local communities and, at the same time, it helps national governments by providing the necessary disease surveillance that is essential for international trade.

### 4. Issues related to marketing

Milk has low shelf life. Quick collection and transportation to consumers are main

prerequisites to market milk properly without any deterioration. Raw milk must be of good quality to produce high quality milk products. Milk quality should not deteriorate during storage and transportation. All possible efforts must be made to preserve its quality during storage and transportation. The basic method to preserve a high milk quality is quick cooling. Many times, the milk does not reach to market due to lack of transportation and preserving facilities. Upto 20% milk is being wasted due to non-availability of proper cooling and storage mechanism or lack of cold chain and chillers (Aziz and Slivia, 2008).

The marketing system for milk does not favour small milk producers. The general backwardness of dairy production and marketing are issues from the past. It can be judged as report by Anjum et al. (1989), that the value of milk produced (26.2 million tonnes) at that time was second after the wheat crop. In this, the commercial herd proportion is only 0.5% while 54.4% consists of rural subsistence herds without any proper marketing facilities while only 33.5% have rural market orientations and 11.5% as peri urban herds that provide milk to urban areas (Anjum et al., 1989). In terms of volume, it is also estimated in a report that out of the total production of 26.2 million, only half of this has access to market, 35% is used by the producer themselves for own consumption or converted to ghee or other milk products and 15% is used for calf feeding or wasted (Aziz and Slivia, 2008). There is still a need for value addition and milk replacers.

At present, condition has not improved much but smaller increase in peri urban milk production and marketing system has occurred. We can estimate that most of milk (more than half) produced by dairy farmer in rural areas has no access to market or is used in calf feeding. This situation led to an annual import of about 1.4 million tonnes of dry milk and milk products during 1999-2000 that consumed approximately Rs. 1213 million of valuable foreign exchange (Anonymous, 1999).

Proper marketing of livestock and its products and by products is not satisfying. Middleman (doodhi) has major role in this and has created monopoly in marketing system and provides little incentive for farmers. It is reported that only 3-5% of total milk production of the

country is marketed through proper channels and remaining is marketed in raw form by informal agents (doodhi) in the marketing chain portion of milk producers (Jalil et al., 2009). Whereas in Germany in 2005, 96% of the total milk production was delivered to dairies and only 4% was used by producers (Aziz and Slivia, 2008).

This existing marketing system provides no benefits to the farmers. Doodhi has to purchase milk in liters at very low costs without any consideration of its quality, fat percentages and dry matter and sell at high rates after adulteration (Hasnain and Usmani, 2006). Majority of the urban citizens have no concern about quality of milk due to their low income. Another issue of the dairy marketing is that prices of milk are fixed by municipal authorities without keeping in view the production cost and transport charges (Raziq et al., 2010). Lack of infrastructure facilities in livestock marketing is an important issue that requires attention for development of livestock business. In Baluchistan, animals are still sold in the open area locally known as Ganj that are lacking facilities such as weighing, watering, feeding, shelter and health facilities (Raziq et al., 2010). A similar fashion is observed in local cattle markets and Eid-ul-Azha days.

##### **5. Lack of value addition facilities**

Value addition facilities are very limited in the country. To make dairying a more profitable industry, prime attention is required on this important issue. In the international markets, there is ever increasing demand of value added livestock products and by-products and these are sold at high prices. Keeping in view, the liking and eating behaviour of the people, some flavors and colours are added to improve their preferences for consumption. In international markets, there is much demand of value added camel and goat milk and opportunities for generating more profits in this field (Raziq et al., 2010).

##### **6. Issue of peri-urban dairy colonies**

A programme was started by the government of Pakistan, in which livestock was depopulated from metropolitan cities so that pollution problems can be prevented. Other aspects of confining milk production to rural areas was to decrease traffic load, rapid migration to cities, to control genetic degradation of dairy stock and

provision of employment opportunities in the rural areas (Sarwar et al., 2002). As a result of this campaign, a large number of cattle colonies have appeared in the surrounding areas of big cities to fulfill the urban demand for fresh milk.

Pregnant animals are bought from villages and are kept on completely stall-fed on cereal straws, green fodders and concentrates. After parturition, most of female calves are sold while only a small number of female calves are kept as replacements for breeding and male calves are fattened upto four months and then slaughtered or sold. After completion of lactation cycle, dry animals with good genetic potentials are also sold out or eventually slaughtered (Sarwar et al., 2002). Another bad practice, which is common in these colonies, particularly, in Landhi colony (Karachi), is use of oxytocine for milk let down and somatotropin BST to increase milk production which causes infertility in animals. Such animals fail to conceive or experience in increased calving intervals or abortion and are eventually slaughtered by butchers. In this way, hundreds of elite buffaloes are slaughtered each year, due to which high quality germplasm is being wasted by indiscriminate slaughtering of animals (Bilal et al., 2005). Rapid growth of these colonies without any regulatory authority and policy interventions has developed an alarming situation which is further complicated by poor hygiene and health risks, such as, contaminated ground water, ever increasing unused manure (Sarwar et al., 2002) and may lead to zoonotic problems. All this has adverse impact on the environment and improper use of methane gas.

#### **7. Institutional constraints**

The conditions of the research institutes and experiment stations are not satisfying. Reasons for their poor performance include poorly trained staff, inadequate operational funds and lack of participation of farmers in their programme planning process (Hasnain and Usmani, 2006). The poor status of the research institutes is an indication of insufficient support by the government. The technology packages produced by the research institutes are limited and, in most cases, not relevant to nature of farming (Hasnain and Usmani, 2006). Due to lack of extension services, these packages are not effectively delivered to farmers and never employed effectively.

Role of credit institutions is limited towards small livestock farmers due to which the influential people get the credit (Raziq et al., 2010). This is a discouraging situation for the real stockmen and need for microfinance at door steps. Animal breeding should be main point of focus in livestock policy for development of livestock. By improving feeding and breeding systems, improvement can take place in dairy production. Raziq et al. (2010) reported that institutes that are conducting research on feeding and breeding issues are limited in country and condition is worst in Baluchistan province where no institute is present for effective redressing of these issues. He also emphasised that facilities to train farmer about the latest technologies are rare in the country and the institutes for training of technicians does not provide quality knowledge about the production issues of livestock. Only health services are provided by technical staff while breeding, feeding and husbandry aspects as well as production of extension services are lacking in respect of training facilities (Raziq et al., 2010).

#### **8. Potential threats to livestock breeds**

Livestock diversity is depleting due to human preferences and environmental pressures. Dairy farming is usually changing farming or production systems according to economy of the area and relevance of a specific breed in the changed economic and farming system (Afzal and Naqvi, 2004). It causes preference of breed which is compatible with these changing conditions. Peri-urban dairying is gaining popularity and subsistence farming is decreasing in Pakistan. Furthermore, human population is ever increasing due to which decrease in ranges and other grazing areas and changes are occurring in crop-production patterns (Afzal and Naqvi, 2004). These factors will force dairy farmers to select those breeds that are more profitable and suitable in the changing production systems, ultimate deletion of poor yield animals

Buffaloes have a vital role in milk production in Pakistan and produce 28 MT out of total 46 MT production (Anonymous, 2010). Since buffalo breeds Nili-Ravi and Kundi are reasonably good milk producers and consumers also prefer buffalo milk to cow milk due to high fat contents, hence flourishing of buffalo as dairy animals is expected. Increase in the buffalo

population has reached at rate of 2.8% per annum (Habib et al., 2007). Conventionally, the use of cattle was as a draught animal for agriculture in Pakistan but their utilisation as draught power has been limited by introduction of the latest machinery for agriculture. As compared to crossbred animals, two milch breeds of cattle, viz. Sahiwal and Red Sindhi, are average producers but inferior in milk production. Thus, there is a threat to their survival and there is need of development of selective breeding programmes for the improvement of these breeds. In the next two decades, most of local cattle breeds (Rojhan, Lohani, Dajjal, Bhagnari, Cholistani, Tharparker and Kankrej) will probably face a real threat for their survival (Afzal and Naqvi, 2004) since they are low milk-producers, have low potential of being developed as beef breeds and irrigation-facilities are slowly replacing conventional methods involving the use of such cattle. Furthermore, grazing areas are decreasing. These conditions will promote buffalo and crossbred animals to be selected as dairy animals.

#### **9. Insufficient extension services**

One of the major issues regarding dairy production is lack of proper extension services, causing low production due to non-adaptation of improved dairy technologies among the dairy farmers (Idrees et al., 2007). Farooq and Qudoos (1999) reported that main cause of non-adaptation of modern livestock practices is unawareness about new livestock technologies, lack of investment and high prices of inputs. Knowledge and information about dairy production can be effectively disseminated through extension workers. It is reported that proper extension services, husbandry practices and effective disease control programme can improve production of dairy animals in remote areas (Moaeen-ud Din and Babar, 2006). Most livestock farmers have increased their production by taking implementation on updated suggestion given by extension workers. Improving existing extension services for adaptation of modern technologies is necessary so that maximum production potential can be achieved in order to fulfill the increasing demand of dairy products to compete with the rapid increase in population and to earn foreign exchange. Functional relationship between various departments can be strengthened by demand-driven extension approach for

services (Idrees et al., 2007). They will work together as a team for providing the demanded services (Qamar, 2004). Improved extension services to the poor farming community can help in uplifting their living standards. In Pakistan, extension staff is located at veterinary hospitals/centers or dispensaries which are generally situated far away from animal population (Hasnain and Usmani, 2006). Condition is same in large cities, although keeping animals in cities has been banned recently. The staff cannot visit the dairy farmers in remote areas due to lack of transport facilities. Usually, the extension workers, belong to the cities, do not know actual needs of rural farmers and have difficulty interacting with livestock producers (Raziq et al., 2010). Poor animal production extension programmes are dangerous for the livestock development also.

#### **10. Low productivity of dairy animals**

Production of milk or other products, e.g., meat or wool, per animal has not improved over a period of time. Present level of per animal productivity is unable to meet the rising demand for livestock products. However, to fulfill demand of increased food production, improved animal efficiency will be an imperative (Dahlin., 1998). In Pakistan, production per animal is low as compared to other countries, like, U.S.A., Germany and New Zealand. For example, three dairy animals in Pakistan produce milk equal to one dairy animal in New Zealand, six dairy animals in Pakistan produce milk equal to milk produced by one animal in Germany and in USA, one dairy animal produces milk equal to seven dairy animals in Pakistan (Garcia et al., 2003). Although Pakistan is one of the major milk producing countries, increase in milk production has been achieved mainly through increase in number of animals (Hasnain and Usmani, 2006).

This difference in milk production has a logical reason which is that livestock population is expanding at much higher rate as compared to resources needed for livestock production. The increase in the resources needed for higher productivity has not been keep in pace with the increasing livestock population. Major cause of low production is that our national livestock herd comprises of large number of low productive animals that are utilising feeding and management of the more productive stock (Iqbal

and Ahmad, 2002). A good digestibility of rumen is required due to which higher productive animals are not producing milk at their best potential. This, in turn, decreases national averages of milk and meat production. Low production can also be attributed to lack of information regarding updated technologies for improved productivity upto the farmers (Farooq and Qudoos, 1999).

### **11. Poor performance of livestock services**

Livestock and dairy development departments in the country are still working at initial levels as veterinary departments and providing only health facilities with limited animal production activities. The services are provided by veterinary graduates (having basic degree/knowledge) and inadequately trained technicians. Their services are clinic-based and provide poor mobility of the extension staff. Hence, animal health services are not reaching more than 25% of population (Hasnain and Usmani, 2006). Breeding services are also limited that can be estimated from that artificial insemination services coverage that is not more than 3% while ignoring the rural areas or remote areas. Over the years, the performance of livestock services is declining due to lack of support for the livestock sector by the government.

### **12. Poor development of milk processing industry**

In past, financial institutions did not have a pleasant experience with the milk processing industry. About 23 milk processing plants for pasteurising and sterilising were imported in the country for development of milk processing industry with huge financial inputs merely provided by banks as loans, particularly by Agricultural Development Bank (ADB) (Sarwar et al., 2002). It was reported by working group on milk in Punjab in 1999 that a large number of milk processing plants are not in operating condition because of improper management of these milk plants with poorly skilled staff, involvement of high level of investment, high price of processed milk, low demand of processed milk and high production cost (Sarwar et al., 2002).

Anjum et al. (1989) reported, after all experimentations, a new set up of Milk Pack Ltd.,

Pakistan, could only able to sell its processed milk in the country, despite of high cost on UHT process. Under 1987 market conditions, price of raw milk was 60% lower than the price mentioned in (Anjum et al., 1989), whereas in 2002, its cost was 50% less than the price of raw milk (Sarwar et al., 2002). It is reported that only 2% of total milk production was utilised by UHT industry (Iqbal and Ahmad, 2002).

Anjum et al. (1989) mentioned in reports, to focus on development of alternative technologies particularly pasteurisation, to promote the usage of hygienic milk and need of working group on milk in the Punjab (Anjum et al., 1989).

### **13. Lack of policy**

It is incredible but true that there has never been a comprehensive policy on livestock. Ullah (1998) reported that government allocated low and insufficient funds for development of dairy sector (Ullah, 1998).

Livestock policies in Pakistan favour horizontal expansion of livestock rather than vertical expansion of the sector (Sarwar et al., 2002). Government has announced agriculture policies several times ignoring the livestock sector. Other dilemma is that the livestock products are not mentioned by Agriculture Prices Commission though total values of livestock products have been increased as compared to all of the major crops. Policy regarding livestock breeding presented by Livestock Division of the Ministry of Food and Agriculture mainly focus with "cross breeding of exotic dairy breeds with non-descript indigenous animal" (Hasnain and Usmani, 2006) but this policy failed to be implemented.

Mostly the experts while formulating the policies are unaware off from the actual scenario and nature of livestock production Moreover there is lack of coordination between the dairy farmer and the experts due to deficiencies in data and untrained staffs also exaggerate the situation (Raziq et al., 2010). Regarding the policies, the needs of the farmers are not kept in mind due to non-coordination with farmers and policies are implemented without taking feedback from the farmers or taking them into confidence.

### **14. Environmental issues due to increasing animal population**

Expansion in animal population has adverse effect on environment. It is reported that when buffaloes are fed by excessive feeding of soluble proteins, there is an increase in excretion of nitrogen and phosphorus in faeces and urine that directly contaminate environment (Habib et al., 2007). Ammonia vaporises from excreta and causes air pollution or green house gases. Excessive phosphorus pollutes the surface as well as ground water. Moreover, run-off and leaching of phosphate into ground water directly leads to eutrophication which effect aquatic ecosystem. Similarly, nitrates in ground water causes human health hazards (Winfried, 1999). Condition is deteriorated in urban and peri-urban farms due to improper disposal of excreta. It is estimated that 70% dietary nitrogen will be excreted when there is traditional feeding of buffaloes in urban and peri-urban farms (Habib et al., 2007). It is reported that in the existing conventional feeding regime, a buffalo would excrete 0.25 to 0.41kg nitrogen in urine per day, that is, equal to 25 to 41kg nitrogen daily excreted through urine in a dairy farm with 100 buffaloes (Leng, 1991). Such colossal amount of nitrogen added daily to atmosphere together with large amount of methane may have an adverse impact on environment. Decrease in the overall efficiency of energy utilisation can also be expected. Sarwar and Zia-ul Hassan (2001) estimated that energy cost of excreting 100g nitrogen in urine is about 4.1 MJ. Methane, largely a greenhouse gas, is produced by livestock and their manure. In Pakistan, methane produced from manure is almost negligible (Hasnain and Usmani, 2006) because of the present extensive system of livestock production. If livestock population continues to increase at present pace and if intensive production system is not introduced, then the productions of the greenhouse gas will double in the next 20 years (Hasnain and Usmani, 2006). Proper and effective use of methane is urgently required.

### **Breeds and breeding issues**

Sahiwal and Red Sindhi are two world famous indigenous dairy breeds of Pakistan but their numbers are small and declining gradually (Hasnain and Usmani, 2006). The condition about the world's best milking buffaloes, viz., Nili-Ravi, is not convincing. The alarming condition is that life of elite female buffaloes used by the peri-

urban milk producers mostly end up in slaughterhouses when dry; this is a major cause in destruction of quality germplasm (Bilal et al., 2005). Availability of breeding bulls is also limited both for cattle as well as buffaloes. Breed improvement work in Pakistan has mainly revolved around artificial insemination (AI) programmes. Usmani and Shah (1986) (Usmani and Shah, 1986) and Khan (1994) reported that breed improvement programme in Pakistan depend on provisions of A.I. Although, Pakistan has well developed infrastructure for the A.I. service in the country, the actual coverage of A.I. service to adult buffalo and cattle females cannot be increased to more than 3% (Iqbal and Ahmad, 2002). Husnain and Usmani (2006) reported only 2.5% of animal have access to AI service (Hasnain and Usmani, 2006).

Selection of bull is important for success of A.I. There is rarely a programme for providing proven bulls to small holders and landless farmers. Presence of undesirable bulls in the herd is the worst aspect of livestock breeding throughout the country (Hasnain and Usmani, 2006). Production and distribution of high quality male are promising aspects that require urgent and special attention for improvement in genetic resources of dairy animals.

In the past, programmes to supply proven bulls were present but have now been discontinued. For example, Pedigreed or selected bulls from elite mothers were provided to the interested farmers in certain localities by the government (Afzal and Naqvi, 2004). These bulls or bull calves were selected from the government livestock-farms. At some places, these bulls were also kept in the veterinary hospitals to provide free breeding-services to the interested farmers. Similarly, a scheme, Lumbardari scheme, was developed in which some land is given to the Lumbardar (village head) for the maintenance of bull for the purpose of breeding village buffaloes and cattle (Afzal and Naqvi, 2004). Now, these programmes have been discontinued.

Land-Grant Scheme was also discontinued in which government granted large pieces of land on long lease as "Land Grants" to the farmers for conservation and propagation of livestock-breeds (Afzal and Naqvi, 2004).

### **Genetic improvement programme**

In livestock genetic improvements, plans have been started by the government. These plans are few in number due to selective breeding and long duration as well as short duration. By proper implementation of these plans, local genetic resources can be improved and preserved in future scenario. The other major genetic improvement plans are as follows:

**a. Access of Artificial Insemination Services**

Despite start in artificial insemination techniques in Pakistan (in late 50s), the development of these techniques is slow. Only 7% of cattle and 5% of buffaloes are bred by this technique (Khan, et al., 2007). There are 7 Semen Production Units and 189 A.I. centers working in Pakistan. At local level, semen for cattle (Sahiwal and Red Sindhi) and buffaloes (both Nili-Ravi and Kundi) is being produced at four semen production centers. Except this, at local level semen from Holstein-Friesian and Jersey cattle is being produced and also being imported from other countries.

**b. Progeny Testing Programme**

In Pakistan, progeny testing programme in Nili-Ravi buffaloes was started in 1978 in central Punjab during 1985. More than 300 bulls have been tested in the programme (Chaudhry, 2002). The accuracy of these evaluations has been low and evaluations have been delayed (Khan et al., 1999). To improve accuracy and start programme in other breeds, proper technical and capacity building assistance is required. Buffalo Research Institute (BRI) was established at Pattoki (Distt. Kasur) in 2005 and is expected to be major step in buffalo recording and improvement in Punjab.

**c. Import of exotic germplasm**

Like many other countries, Pakistan has also imported exotic cattle in an effort to establish these breeds in the local environment. Several exotic breeds of cattle, notably "Holstein-Friesian, Jersey, Red Dane and Australian shorthorn" have been imported with various objectives including establishment of nucleus herds, use in crossbreeding programmes or to develop commercial units of modern dairy-farming. Due to poor adaptability, these animals, under local environmental and management conditions, usually lost their high productive capacity (Afzal and Naqvi, 2004).

**d. Crossbreeding**

In Pakistan Pure-bred cattle comprise 25-30% of total population and rest are "non-descript low producers". There are about 2 million crossbred cattle in Pakistan (Afzal and Naqvi, 2004).

Cattle crossbreeding started in Pakistan in early 1970 and "National Breeding Policy" was formulated by which crossbreeding was limited to only non-descript cattle (Hasnain and Usmani, 2006) but that has not been adopted as yet.

**e. Research need for genetic improvement**

Main research and development needs in field of genetic improvement of livestock areas follows: for genetic improvement of livestock, basic requirement is development of uniform performance record. An economical model for record keeping of performance is necessary and should be applied in different geographical and socio-economic areas of the country. Development of molecular markers, on the basis of economic traits and utilisation in selection of animal can help in genetic improvement (Riaz et al., 2008). In molecular marker assisted selection in large and small animals, research should be conducted on genes responsible for growth rate and milk production. For Sahiwal cattle and Nili-Ravi buffalo, progeny testing programme should be improved and applied properly. In Sindh, for Kundi buffaloes and Red Sindhi cattle programmes of breed improvement should be started. This programme should involve farmers and make them a part of the organisations, so that this programme can become successful. Production potential and genetic relationship of different buffalo breeds, like, Bhuri Kundi buffalo, white Nili-Ravi and Azakheli, should be examined for all breeds of cattle and should be characterised genetically as according to current scenario in farming. Specific phenotypic characteristics, like, tick resistance, disease resistance of different cattle breeds, should be determined on priorities and a conservation policy should be formulated. Dairy breeds need selective breeding programmes that should be initiated by self-sustenance for long duration. To study these breeds properly, molecular genetic studies should be considered and results should be applied regarding these breeds.

**Recommendations for strengthening the industry**

Last, but not least, primary purpose of developing efforts is improvement of production per animal per head. By application of short-term, as well as, long-term improvement programmes by efficient use of local feed resources, application of improved management of feeding and development of alternate can be adopted. Long-term improvement programme policies should consider selective breeding of local breeds of buffaloes, cattle and well organised crossbreeding programme, use of semen of progeny or pedigreed tested bulls and by maintaining proper artificial insemination (AI) network.

In Pakistan there is need to improve quality as well as quantity of veterinary services. Proper diagnostic facilities should be available in veterinary hospitals and, moreover, suitable veterinary medicines should be available in dispensaries. The production of quality vaccines of all important diseases for maximum or annual coverage can be achieved by strengthening Veterinary Research Institutes (VRI). These efforts will result in decreased morbidity and better performance of animals.

There is a dire need to improve milk collection system either by purchase of milk at farm gate or by minimising the role of middle man (doodhi). There is also a need to provide transportation facilities to transport milk from rural areas to urban areas, to increase post harvest life of milk, chillers may be established in rural areas with continuous power supply.

Latest technology should effectively deliver benefit to small farmers at farm level and for such purpose, extension services should be improved and strengthened. Participation of farmer should be ensured. Research institutes should be interlinked with private sector to deliver mechanism and technologies upto grass root level.

Emphasis is one establishing genetic-improvement programmes for breeds having high production potential and this can be achieved by providing high quality bull, improving A.I. services and by proper performance record maintenance and hygiene.

Lastly, trainings and skill development programmes for small holders, especially, for women, should be carried out regularly to improve livestock production.

## Acknowledgements

I acknowledge the efforts of all the co-authors who gave me support in conduction of this study and preparation of this manuscript.

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