



Breed Improvement in Punjab: Assessment and Recommendations

Livestock and Dairy Development Department

Punjab Government Efficiency Improvement Programme

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Executive Summary

This report is a situation analysis of breed improvement in Punjab. It was conducted by Dr Hans Gerhard Wagner as part of the Punjab Government Efficiency Improvement Project – a project of the Government of Punjab, managed by the Punjab Resource Management Programme (PRMP).

The situation analysis found that Punjab has unique genetic resources that are well adapted to its local conditions. There is an enormous untapped potential to increase the output for milk and meat to meet the requirements of the growing population and for possible export. The gap between supply and demand is projected to be 55 million tons of milk and 2.3 million tons of beef by 2020.

The breed improvement in Punjab is based on artificial insemination, a practice that is well accepted, with more than five million inseminations in cattle and buffalo annually.

Semen is produced by four public SPUs and 11 private SPUs. In terms of production, the private sector is clearly out-producing the public sector, at 3.7 million doses compared with 2.7 million doses in 2010/2011.

There is no mechanism in place for the accreditation of SPUs and AI technicians to guarantee that they meet required standards.

With the exception of some good but limited efforts by the Research Centre for Conservation of Sahiwal Cattle in Jhang, at the Buffalo Research Institute in Pattoki and at the Livestock Production Research Institute for cattle and buffalo, there is no continuous and consistent pedigree and performance recording scheme in place. Bulls are selected on the phenotypic absolute milk production of their dams without any genetic analysis and can therefore only be considered of random quality.

The scanty data that were analysed in 2008 indicate that over the years, at least for Sahiwal, the genetic progress has hovered around zero.¹

There is no pedigree and performance programme with the necessary number of animals and the consistency that would allow accurate selection based on the estimated breeding value of young bulls for the SPUs and their subsequent progeny testing. So no genetic progress can really be expected.

The importing of exotic animals alive or through embryos and the unregulated use of imported exotic semen has led to a herd of pure and exotic crosses of more than three million head, already more than the local Sahiwal population. If this trend continues, the local genetic resource that is considered unique in the world could be under threat.

The Directorate of Breed Improvement has developed, over time, a number of good projects, Acts, standards and regulations that, unfortunately, have not had the expected impact. Some of them have not been enacted while others could not be fully implemented due to a number of constraints – technical, financial and lack of human resources.

The province has an enormous potential to increase dairy production to meet the demand of the growing population. But the public sector has yet to deliver the necessary genetic improvement programme and will not be in a position to do so in the future. The public sector should therefore disinvest from activities which are already now dominated by the private sector. The role of the Government is to establish a clear policy and develop a comprehensive regulatory and compliance framework, and to ensure that the different stakeholders play by the rules to protect the large farming community and to guarantee the growth of the sector.

¹ Khan, 2008. Estimation of breeding values of Sahiwal cattle using test day milk yields. Pakistan Vet. Journal 18(3):131-135.

1. Introduction

According to the Punjab Livestock and Dairy Development Department, in 2010-11 there were 17.4 million cattle and 20.6 million buffalo in the province of Punjab (up from 14.4 million and 17.8 million respectively in the 2006 Pakistan Livestock census), constituting 49 percent and 65 percent, respectively, of the country's large ruminant population.² These animals supply with meat and milk both Punjab households as well as neighbouring provinces (many of the animals, mainly the lactating buffalo, are sold to peri-urban farms outside cities in other provinces).

2. Dairy Production

The annual milk production in Punjab is estimated at 21 million tons, of which 70 percent is from buffalo. Punjab contributes over 50 percent of the national production; this figure underlines the importance of the province's dairy production for the country.

From 1996 to 2002, milk production increased in Punjab by 17 percent (still providing over 50 percent of the national production). Milk from buffalo increased by 18 percent and from cattle by 17 percent. The increase was mainly due to growth in the numbers of animals, with very little increased productivity: the buffalo population expanded by 18 percent in that same time period, while cattle and cross-bred animals increased by 12 percent. To meet the domestic demand of milk and meat, the rate of livestock population growth must be at least 5–7 percent per annum.³

As a result of on-the-ground constraints and inadequate government support, however, livestock owners are unable to meet the growing market demand for milk and meat. By 2020, the gap between supply and demand is projected to be 55 million tons of milk and 2.3 million tons of beef.⁴ Yet, the population of livestock indicates an enormous resource and an untapped potential that could rise to the size of the demand if the constraints were to be addressed and removed.

The primary constraints to livestock and dairy development were summarized in the April 2010 report Livestock Sector Strategy for the Government of Punjab. This report, which summarises the conclusions of a situation analysis conducted by Dr Hans Gerhard Wagner as part of the PRMP Punjab Government Efficiency Improvement Project in January 2012, focuses on issues of breed improvement, although recognizing that increased productivity is a combination of genetics, nutrition and management.

3. Genetic Resources

The indigenous livestock genetic resource in Pakistan, which is perfectly adapted to the difficult local environment, is considered unique in the world.

At 15.4 million head, Nili-Ravi is the main buffalo breed of Punjab, with Nili and Ravi breeds still found in their respective home tracts. The buffalo population lives in eastern Punjab and produces 65 percent of the province's milk and 45 percent of its beef.

Of the 17.4 million head of cattle now estimated in the province, the important dairy breeds are Sahiwal (at 2.4 million head), Cholistani (600,000), Lohani (160,000) and Dagal (0.01). The Hissar (0.01 million), Rohjan (200,000) and Dhanni (1.3 million) breeds are for draught and meat. A very large number of cattle (the number varies among experts) cannot be clearly attributed to any one of these breeds and are classified as non-descript, or Desi, and estimated at 8.4 million head.

² The numbers vary widely Afzal (2008) quotes the Economic survey where the Pakistan cattle and buffalo population is given as 24.2 and 26.3 million respectively and the Punjab share of 43.2 and 60.8 respectively.

³ International Fram Comparison Network, Otto Garcia, Khalid Mahmood and Torsten Hemme, A review of milk production in Pakistan with particular emphasis on small-scale producers, FAO-PPLPI Working Paper No.3

⁴ Jane E. Austin Associates, 2006, The white revolution, Pakistan Strategic Working Group Strategic Plan USAID.

Over the past few years, the number of pure exotic or exotic-cross animals has increased dramatically; at three million head, they outnumber the Sahiwal, which was once the most important dairy cattle breed in the province. The main exotic breeds from which animals or semen for cross-breeding have been imported are the Holstein Friesian and Jersey. A limited quantity of semen from beef breeds, such as Angus, Charolais and Hereford, have been imported for cross-breeding trials with the Desi cattle.

An International Farm Comparison Network (IFCN) study⁵ in 2003 found that little attention had been given to improving local cattle, except for their use as a resource pool for cross-breeding with exotic dairy animals for the supply of F1 cross-bred cows. The IFCN researchers reported that local Sahiwal, Cholistani and Red Sindi cattle breeds had practically disappeared in their pure form, which had been quite adaptable to the local conditions. The Government do not agree with this opinion (believing that several hundred thousand of local pure animals remain); but the study's assessment clearly indicates a threat to the local breeds if no appropriate protective action is taken soon.

The impact and the possible threat of the imports on the national genetic resources and diversity are dealt with further on in this report.

4. Production System

Livestock farmers in Punjab can be categorized as one of four categories of production systems:

- *Rural subsistence smallholdings:* These farmers have no more than two or three cattle of the local breed or buffalo, including young stock, and produce mainly to meet family needs. The input levels in this group are very low. Animals are a kind of savings bank and sold when there are financial needs. For the mating of their females, they depend on either bulls owned by neighbours or an artificial insemination (AI) service. The genetic quality of the bulls is of little concern to the farmers.
- *Rural market-oriented smallholdings:* The majority of the milk-selling households belong to this category, which provides the bulk of the marketed milk supply. Buffalo and cows, mainly of the local breeds, are still kept traditionally but are better looked after in terms of feeding and management. Farmers own up to six animals, a number that does not economically justify keeping a bull. For mating, these farmers depend on AI or natural mating. To enhance milk production, farmers add concentrates to the feed, consisting of green fodder and straw. 88 percent of the framers belong to these first two groups possessing less than 6 animals mostly a combination of buffaloes and cows.⁶
- *Rural commercial farms:* This group consists of specialized dairy farms and mixed crop-livestock farms having more than 40 animals, which are mostly buffalo but increasingly pure exotic or cross-bred cows. Because of economies of scale and the availability of adequate financial resources, it becomes possible to maintain breeding bulls on such farms. Many farmers in this category concentrate on developing their breeds and keep highly productive milk animals.
- *Peri-urban commercial dairy farms:* This system flourishes around cities in the form of gawala colonies. The typical herd size ranges from 15 to 50 animals, which are mostly buffalo. This is a high-turnover, high-cost system. The cost disadvantage relates primarily to the distance from cheap fodder sources in the agricultural hinterlands. As a result, the gawalas keep only the animals that are lactating or very close to the lactation stage. Dry buffalo and cows are either sold back to farmers or to the slaughterhouses. Marketing margins for this group tend to be high because there are few or no market intermediaries between them and the final consumers.

⁵ FAO, 2003 PPLPI Working Paper No. 3.

⁶ Punjab Strategy for Accelerating Growth and Improving Service Delivery, Punjab Economic Report 2007.

Each of these production systems requires a specific breed or breed combination for maximum profit and success:

- *Rural subsistence smallholdings*: local buffalo and cattle breeds that are hardy and can cope with a low level of management and feeding.
- *Rural market-oriented smallholdings*: improved local buffalo and cattle breeds that can respond to improved feeding and management with increased production. In the better-managed farms, cross-breeding, if it does not go beyond 50–75 percent of the herd, can contribute to increased productivity and financial returns.
- *Rural commercial farms*: high-yielding improved local cattle breeds, improved buffalo and local cattle breeds crossed with exotics are justified as good; feeding and management can be provided. For very well-managed farms with good feed resources, pure exotic breeds may be justified.
- *Peri-urban commercial dairy farms*: generally these farms source their animals from the other farm types. If the farm produces its own replacements, cross-bred animals (or even full exotics) will be the preferred choice.

5. Artificial Insemination

5.1 Semen Production Units

The production of cattle and buffalo semen in Punjab is shared among the four government semen production units (SPUs) in Qadirabad, Karariwala, Kallurkot and Rhenala (military farm) and 12 private SPUs. The latter ones produce between 50,000 and 1,030,000 doses of semen annually, with 7–108 bulls. Exotic and exotic-cross bulls can only be found in private SPUs and in the military-managed SPU in Rhenala.

Several private players are planning to open new units with capacities for millions of doses of semen. Anyone can set up an SPU; there is no regulatory framework in place for registration and accreditation, which would otherwise guarantee the production of semen of genetic, biological and hygienic quality that meets established standards. In 2008, the Punjab Standards for Public and Private Semen Production Units and Quality Control Regulations was prepared but never enacted.

The private SPUs claim that they maintain genetically superior males of the different breeds. This is, in the absence of a genetic improvement programme, not verifiable. Their bulls have the same average quality as the ones in the public SPUs. The only exception could be imported bulls or bulls from imported embryos with known paternity and genetic make-up.

5.2 Semen Production

In 2010–2011, the private and public SPUs kept a combined 662 bulls. The private sector, with a total production of 3.7 million semen doses, clearly outperformed the public sector, with its 2.1 million doses and the 0.6 million doses produced at the military farm SPU at Okara.

Table 1: Bulls at semen production units, by species and breed

	<i>Buffalo</i>	<i>Sahiwal</i>	<i>Cholistani</i>	<i>Dhanni</i>	<i>Friesian cross</i>	<i>Jersey</i>	<i>Other</i>	<i>Total</i>
Public	183	172	8	2	-	-	-	365
Private	70	102	-	-	102	8	15	297
Total	253	274	8	2	102	8	15	662

Table 2: Semen production (doses), by species and breed

	<i>Buffalo</i>	<i>Sahiwal</i>	<i>Cholistani</i>	<i>Dhanni</i>	<i>Friesian cross</i>	<i>Jersey</i>	<i>Other</i>	<i>Total</i>
Public	89,000	1,157,000	64,000					2,110,000*
Private	719,000	1,720,000			1,137,000	103,000	6,000	3,739,000
Total	1,609,000	2,877,000	64,000		1,137,000	103,000	6,000	5,894,000

* 591,000 doses produced at the SC&PC Renala have to be added to this amount

The private SPU operators claim that all the semen doses produced are used instantly because their service is in high demand. A portion of the semen produced in the public SPUs is kept in storage, pending progeny test results. The public sector is currently storing several million doses, at high storage costs, while awaiting the progeny testing results. On the other hand, there is no initiative to undertake progeny testing of their bulls in the private sector.

5.3 AI Delivery

Artificial insemination services are delivered by AI technicians and veterinarians on a fee basis. The fee covers the costs for the semen doses and the service. The cost of semen dose varies between the two sectors, with public SPUs currently charging 50 rupees per dose while the private operators charge 20-40 rupees. The service fee also varies between the private and public AI technicians, although the latter should be free.

The number of private AI technicians is increasing due to the popularity of the service delivered at the farm; while animals inseminated by the public AI technician need to be taken to the AI point. The private sector is also preferred because of the higher efficiency of the private AI technician and the lower costs.

5.4 AI Coverage

In the absence of hard data on AI success rates, it is assumed that three and two semen doses are required respectively to impregnate one buffalo or one cow, respectively. Under this assumption, some 500,000 buffaloes have been mated successfully as well as 1.4 million Sahiwal, 30,000 Cholistani cows and, remarkably, about 1.2 million exotics (Friesian, their crosses and Jersey).

Based on those figures and assuming there are 5,690,000 cattle and 7,930,000 buffalo "ready to breed", the AI coverage (private and public) would be 46 percent for cattle and 12 percent for buffalo. (It is believed more appropriate to consider "total breedable females" as the basis; thus, assuming there are 8.5 million cows and 11.6 million buffaloes, AI coverage would be 32 percent for cattle and 2.3 percent for buffalo).

The very low percentage coverage in buffalo can be explained by the challenges of managing reproduction at the small farmer level and the low success rate in AI, at around 30 percent. The management of the reproductive performance in buffalo (heat detection, silent heat and poor AI success) requires special attention by both researchers and extension services.

As noted, the remarkable high demand for exotic breeds, amounting to 1,240,000 doses, is exclusively supplied by the private SPUs. This clearly indicates an increasing demand for better-quality producing animals in the rural commercial sector and in the new farms being set up in the vicinity of cities to supply urban dwellers.

In addition to the local semen production, a large quantity of doses from exotic breeds is imported. The import permit is given by the federal Government, leaving the provincial Government with no control over numbers, genetic quality and use of the imported semen. An estimated 150,000 doses are brought into Punjab annually (or even 400,000 doses according to some sources).

The Livestock and Dairy Development (L&DD) Department advises that exotic semen should not be used to inseminate cows of the established breeds but only with non-descript cattle. Further, the crosses should not exceed 75 percent of exotic inheritance. This is not always adhered to, with negative consequences on productivity due to the loss of adaptation to the local conditions.

The increased use of exotic semen to the detriment of the local adapted breeds, even though some have very high milk yields, is the consequence of the absence of an approved breeding policy and strategy, together with weak advisory and extension services.

5.5 Natural Breeding Services

In the smallholder production system in which farmers own only a few cows, it is not economic to keep a breeding bull. Farmers depend either on AI, a communal bull or a neighbouring farmer who keeps one or more bulls to provide mating service for a fee. Considering the relatively low AI coverage, there is a large number of natural-service bulls that, because of the absence of a genetic-improvement programme, can only be considered at best as random genetic quality.

The light coverage of AI thus leaves about 3 million cattle and 7.4 million buffalo requiring natural mating. At a ratio of one bull for 50 cows or buffalo, that means approximately 60,000 bulls and 148,000 buffalo would be required. If we accept that genetic improvement in animals for the smallholder farmer is desirable and estimate an annual replacement rate of 30 percent, we can conclude that 20,000 bulls and 50,000 buffalo would be required for a genetic-improvement scheme covering the province of Punjab.

6. Breed Improvement - Genetic Improvement

Artificial insemination is the most powerful tool for the broad and rapid distribution of genetic progress in the livestock population. AI for productivity improvement is only justified if the bulls used in the SPUs are of higher genetic merit than the average of the population.

Bulls for the public SPUs are generally sourced from government farms, based on the lactation yield of the cows. However, a high lactation yield is no indication of genetic superiority of the animal. Milk production is the sum of the genetic merit of a cow for milk yield (the effect of the genes) and the effect of the cows management and environment ($M=G+E$). As in general the genetic effect is somewhat between 20 and 40 percent it only indicates that the animal has responded well to the improved environment. Since 2008, there have been no funds to purchase bulls from outside the government farms.

The majority of the bulls for the private SPUs are bought from private farmers. The L&DD Department has no control on the quality of bulls recruited by the private SPUs.

The paternity of the bulls selected also cannot be guaranteed. A study based on DNA paternity analysis by the University for Veterinary and Animal Science in Lahore could not confirm a high percentage of claimed paternities.⁷

Every report that addresses the issue of livestock production improvement in Punjab deplores the poor genetic make-up of the bulls that are recruited for the SPUs and the absence of continuous and reliable progeny testing programmes.

In particular, Afzal noted in 2008 the “unavailability of superior germplasm from known source”.⁸

A 2007 study of lessons learned noted that “Due to lack of proper management practices and poor breeding, animal production tends to be very low resulting in low farm profitability and reduced national productivity.”⁹

⁷ Personal communication.

⁸ Livestock and Dairy Development Board Pakistan, 2008. Dairy sector Pakistan, by M. Afzal.

⁹ FAO, 2007. Lessons learned study – Pakistan. CFC/FIGMDP/16FT.

The Punjab Livestock Development Policy 2007 identified the “unavailability of superior germplasm” as a key issue and highlighted the absence of consistent, systematic and long-term programmes aimed at improving the genetic potential of local dairy animals. Progeny-testing programmes of Nili-Ravi buffalo and Sahiwal cattle at limited scale were minor exceptions. Overall, the policy noted, there was an extreme shortage of progeny-tested bulls.

Over the years, there has been only a slight increase in milk production from cattle and buffalo overall in Pakistan. This is due to the limited impact of the breeding schemes through selection and artificial insemination and the too little attention given to improving the local cattle and buffalo populations.

6.1 Ongoing Genetic Improvement Attempts

Attempts have been made to establish a milk recording scheme; some of them date back many years. The Livestock Production Research Institute (LPRI) in Bahadurnagar initiated a programme for progeny testing for buffalo and Sahiwal. The shortage of staff and funds were the major reasons why it did not expand and gain importance.

For the Sahiwal breed, Khan (2008) analysed a limited data set from 1985 to 2005 for the Livestock Experiment Station (LES) in Jahangirabad and concluded that the genetic trend for 305-day milk yield was close to zero, with wide fluctuations in recent years.

Two current programmes are noteworthy:

1. The progeny testing programme for buffalo by the Buffalo Research Institute in Pattoki, which started in 2005/2006, covers three institutional herds and 15,000 registered buffalo of private breeders in ten districts of Punjab.
2. The programme for the conservation of the Sahiwal breed through genetic improvement and management at the Research Centre for Conservation of Sahiwal Cattle (RCCSC) in Jhang. The programme started in 2005, although an earlier attempt dates back to 1985 at the LPRI in Bahadurnagar that continued at the LES Jahangirabad (in Khanewal). In the Jhang programme’s second phase (2008–2009), 15 districts in Punjab and a registration target of 5,000 cows were added, bringing the total number of animals under recording to about 15,000.

Both programmes follow the same selection plan (see figure 1), with slight differences in numbers between the Sahiwal and buffalo mainly due to differences in reproductive performance.

Both programmes are a highly commendable start, but they struggle with a number of problems. The test capacity is still limited and the field recording is very difficult. The target number of 25 daughter lactations per test bull is hardly reached; 25 daughter lactations are considered the absolute minimum for a progeny-tested bull. For better accuracy and reliability, 40–50 daughter lactations per test bulls are recommended (under European standards, 100 daughter lactations are required). The present number of cows and buffalo under recording limit the number of bulls that can be progeny tested; present and future requirements of the AI service in the country cannot be met.

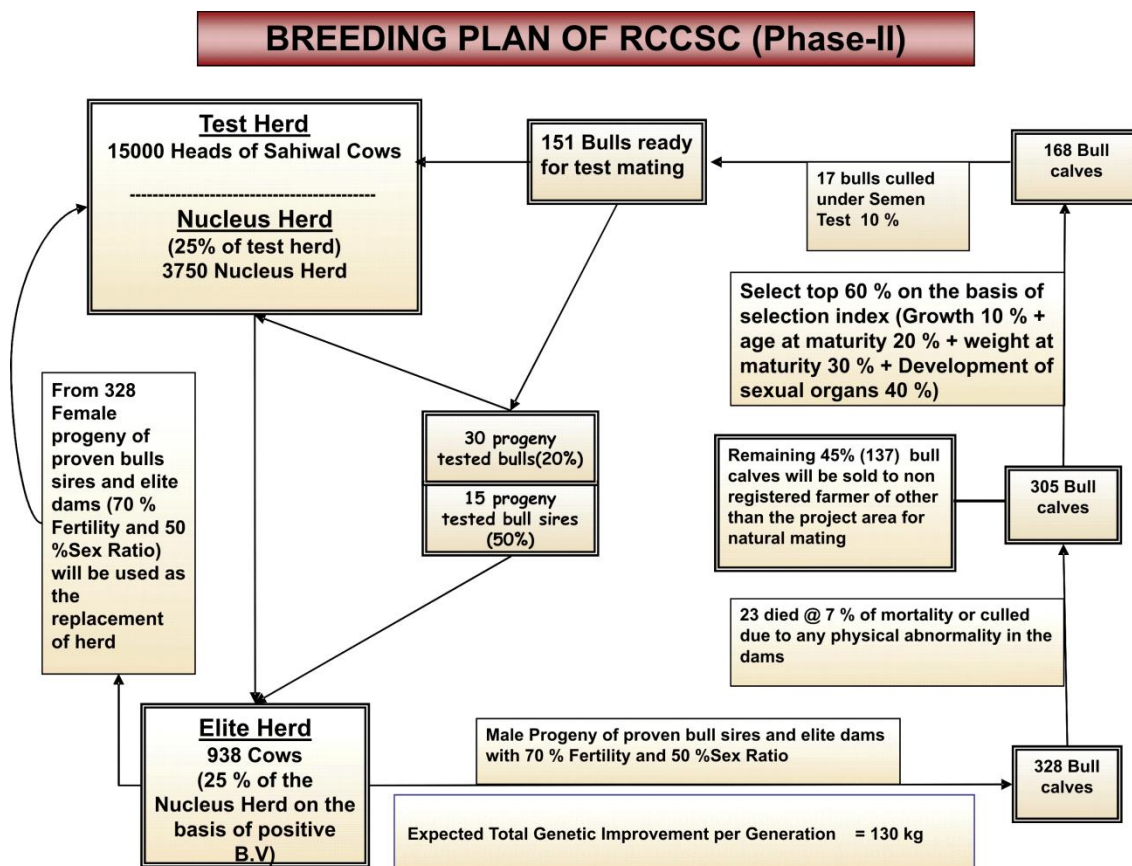
Currently, only the milk yield is being considered. The inclusion of milk fat and protein as important economic traits is considered imperative. Reproductive traits, particularly in the buffalo, need also to be included in future analysis.

A third forthcoming initiative is the Centre of Excellence for the Development of Sahiwal and Exotic Breeds of the Punjab Livestock and Dairy Development Board, a company under Section 42 of the Companies Ordinance. The Centre of Excellence is planned to be a state-of-the-arts semen production unit with a capacity of one million doses and sexed semen technology. Its specific objectives are:

- Improving the reproductive efficiency of cattle and reducing calving intervals;
- Conserving and developing the Sahiwal and Cholistani breeds by providing a facility for exotic and cross-bred semen;
- Providing sufficient supply of semen from indigenous as well as exotic cross-bred cattle.

There seems to be some controversy, however, because the plan would duplicate some of the ongoing activities, particularly with the research centres in Pattoki, Jhang and the semen production unit in Rhenala. It has been suggested that a committee should be appointed to review the role and mandate for the Centre of Excellence.

Figure 1: Breeding Plan of RCCSC (Phase II)



7. Institutional Setting

In April 2011 under the country's devolution plan, the Ministry of Livestock and Dairy was transferred to provincial jurisdiction, where it became the Livestock and Dairy Development Department. Within the Department, the responsible entity for breed improvements is the Directorate for Breed Improvement under the Directorate General Extension.

Its mission statement is: "Livestock productivity enhancement through community public partnerships." Its objectives are:

- Genetic improvement in the indigenous Nili-Ravi buffalo and various breeds of cattle through artificial insemination service;
- Diagnosis and treatment of reproductive disorders affecting productivity;
- Venereal disease surveillance of farm animals, especially bulls maintained at semen production units.

8. Punjab Livestock Breeding Policy

The Directorate for Breed Improvement is ably managed, but several proposed actions, standards, guidelines, policies and Acts have not been formally approved or their implementation is weak and incomplete.

For example, a comprehensive Livestock Breeding Policy was drafted after a thorough debate involving all stakeholders and included the following objectives:

1. Improve milk production of buffalo and local dairy cattle breeds through selection.
2. Reduce the age at first calving and calving interval of buffalo and dairy cattle.
3. Conserve the recognized buffalo (Nili, Ravi and Nili-Ravi) and cattle (Sahiwal, Cholistani, Dhanni, Dajal and Rohjan) breeds as purebreds.
4. Manage the desired level of exotic blood in cross-bred cattle for their optimum performance, at 50 percent or less for small farmers and 50–75 percent otherwise.
5. Ensure the availability of good-quality indigenous animals for draught and beef purposes.
6. Regulate the quality of the breeding services.

The policy is still pending formal approval and necessary notification.

In 2006, the Directorate developed comprehensive standards and regulations for public and private semen production units, imports and quality control that require:

- Minimum standards for production of semen, including performance standards for dams for breeding bulls;
- Regulations for SPUs (including accreditation procedures for private SPUs);
- Guidelines for use of frozen and liquid semen and natural mating;
- Training and accreditation of AI technicians;
- Requirements of use of semen from exotic breeds.

Unfortunately, the standards have never been made official and so have not become part of the regulatory framework.

In 2011, the Directorate developed the Punjab Livestock Breeding Act to regulate the livestock breeding services in the province and to improve the genetic potential of indigenous breeds (full text included in the Annex A). The Act provides a basic framework without going into the same level of detail as with the drafted 2006 standards. Rules and amendments to the Act will be published through notifications in the Official Gazette. The Act covers the following issues:

- Creation of a Livestock Breeding Control Unit, supervised by a registrar;
- Regulation (standards) of the selection of breeding animals and the need for milk recording and progeny testing;
- Regulation (standards) of the semen production units and their accreditation;
- Regulation of the use of fresh and frozen semen and a breeding policy for the conservation of local breeds;
- Regulation of the training accreditation of AI technicians;
- Requirements for the use of exotic semen.

The proposed Act is an excellent step forward, but is still pending approval.

9. Recommendations

The public sector has yet to deliver the necessary genetic improvement programme and will not be in a position to do so in the future. There are a number of activities that can be delivered by the private sector more efficiently and more cost effectively.

Overall, the public sector should focus on setting standards and guidelines and guarantee that all players conform to them.

9.1 Breeding Policy

There is no national or provincial breeding policy that has been adopted. There are proposals and drafts, but nothing has been officially accepted. In following up the *State of the World's Animal*

Genetic Resources country report and to meet the requirements of the Global Plan of Action, developing the national breed improvement policy and strategy should have the highest priority.

The policy document should address the following items for large ruminants:

- a. Cattle
 - Sustainable development and conservation of local dairy breeds
 - How to deal with cross-breeding and the importing of exotic breed semen
 - Sustainable development and conservation of local meat and draught breeds
- b. Buffalo
 - Sustainable development and conservation of local buffalo breeds
 - Role of buffalo for beef production.
- c. Developing a synthetic breed (cross-breeding of local breeds with exotic imports).

9.2 AI Service

The PC-1 Restructuring and Reorganization of Breeding Services project of 2009 had the following objectives, among others:

- Develop an efficient and effective service delivery system through the induction of the private sector community;
- Support the private sector for building up the capacity of service providers and establishing a network of breeding services.

The project's strategy was to transfer the service delivery system to the private sector and divert the funds saved towards the production of quality breeding bulls.

The privatization of the AI delivery (AI technicians) is fully supported. The private AI technicians now perform already more inseminations than the public ones.

It is recommended to go even further and phase out gradually or privatize the public SPUs. The additional requirements can easily be met by the private sector. When AI delivery services and SPUs are privatized, the need for government farms and calf-rearing centres should be reconsidered.

It is also recommended that the Government put in place and enforce very clear standards (as have already been drafted by the Directorate) to protect the farmers. The standards should concern:

- Establishment and conditions for the accreditation of an SPU
- The genetic quality of young AI bulls
- The progeny testing and criteria for a bull to be qualified as a tested bull
- Reporting obligations
- Training and accreditation of AI technicians.

The Directorate of Breed Improvement will have a key role in monitoring compliance and acting in case of infringements.

9.3 Genetic Improvement

Genetic improvement is slow. In an efficient programme to improve milk production, an annual genetic progress of 1–2 percent can be expected. But genetic improvement is:

- Permanent; once achieved it is fixed in the genome and will be passed on again and again. This is in contrast with feed, for which an improvement will result in greater production, but if the preferred treatment stops, production drops again.

- Cumulative; because a genetic-improvement programme is a continuous process, the progress will be achieved every year.
- Multiplicative; progress achieved in a small part of the population (under recording) can be multiplied through AI to millions of animals very cost effectively.

Genetic improvement of cattle and buffalo is only possible if a pedigree and performance recording scheme (PPRS) is in place. Such a scheme needs to allow the genetic analysis of the data to identify with high accuracy and reliability the genetically superior females that will serve as bull mothers and to conduct progeny testing. High accuracy and reliability are important because these sires will be multiplied via artificial insemination through thousands of doses of semen. The present selection criteria of dams based on their milk yield is not considered appropriate, but is, admittedly, the only possibility in the absence of a PPRS.

It is recommended to initiate a PPRS for cattle and buffalo that within five years will develop the necessary coverage to allow all SPUs to recruit young bulls with known genetic make-up and to conduct progeny testing. One of the conditions for the accreditation of a SPU will have to be that as of 201X (date has to be set by the L&DD), only bulls with a genetic make-up can be recruited for testing.

The PPRS will be based on the experiences of the work already achieved by the Research Centre for Conservation of Sahiwal Cattle in Jhang and the Buffalo Research Institute in Pattoki. Herds under recording by the RCCSC and BRI will be the start and the PPRS will further expand the programme, including other districts as well. The running of a large-scale PPRS for commercial purposes is not considered the mandate of a research institute.

Who will thus run the PPRS? Despite many attempts, the public sector has not been able to establish a PPRS that would allow the selection of young AI bulls and their progeny testing on the required scale. It is recommended to involve the private sector and to establish a private sector led entity or consortium to manage the PPRS with active support by the public sector. The public sector will establish clear standards and will supervise their application.

Recommended stakeholders or interest groups for the entity or consortium are the followings:

1. The SPUs, because they need the PPRS to meet the standards set by the L&DD Department:
 - a. to recruit bulls of known genetic merit
 - b. to do the necessary progeny testing.
2. The breeders' organizations or groups through which the bulls will be sold.
3. The farmers or breeders, who will have:
 - a. a monthly report on the performance of their animals on which they can base feeding management and selection decision;
 - b. males and females for sale with known genetic merit for which they should achieve a higher price.

Only a functioning PPRS will allow the SPUs to meet the requirements set up by the L&DD Department, i.e. that only bulls with a certain genetic make-up can enter the SPU and that bulls have to be progeny tested.

It is recommended to establish an entity/consortium that could be named: Punjab Livestock Genetic Improvement Centre (PLCIP). The most appropriate legal form has to be discussed and agreed, perhaps a Section 42 company.

The shareholders or board members would be representatives of:

1. The SPUs (mandatory)
2. The breeders' organizations (mandatory)
3. Farmers
4. General manager

5. L&DD advisory supervisory
6. Research centres (Research Centre for Conservation of Sahiwal Cattle (RCCSC), the Buffalo Research Institute (BRI), the Livestock Production Research Institute (LPRI) and the University for Veterinary and Animal Science (UVAS).

Officers of the L&DD Department, RCCSC, BRI, LPRI and UVAS could be assembled in a technical advisory board to provide technical and scientific advice.

For discussion, a possible **functional** structure for the Punjab Livestock Genetic Improvement Centre is proposed in Annex B.

Appendix A: Draft Punjab Livestock Breeding Act

DRAFT

Punjab Livestock Breeding Act

[to regulate the livestock breeding services in Punjab]

Preamble: Whereas it is expedient to regulate the livestock breeding services in the province and to improve the genetic potential of indigenous breeds.

It is hereby enacted as follows:

Chapter-1

PRELIMINARY

1. Short title: extent and commencement.—

- (1) This Act shall be called The “**Punjab Livestock Breeding Act- 2011**”.
- (2) This Act shall extent to the whole province.
- (3) This Act shall come into force at once.

2. Definitions: in this Act:

- a) **Approved Animal:** Animal kept for breeding purposes as approved by the Registrar or the Animal Approving Committee
- b) **Approved Lab:** ISO certified Laboratory situated in Punjab/Pakistan designated by competent authority (PNAC/any other accreditation agency) to carry out the tests, as prescribed in the rules/regulations made under this Act.
- c) **Artificial Insemination (AI):** The technique for inserting the semen into the female reproductive tract by using artificial means.
- d) **Breeding male:** A male animal of any species fulfilling the criteria spelt out in the prescribed rules framed under this Act.
- e) **Code:** Of criminal procedure 1891(V of 1998)
- f) **Consignment** means a quantity of semen covered by a single certificate
- g) **Donor breeding male:** Proven or a test breeding male as approved by the Registrar or Animal Approval Committee formed under the prescribed rules.
- h) **Government:** Government of the Punjab
- i) **Import of Semen:** Bringing into Pakistan the frozen semen by air, land, or sea in the shape prescribed under the relevant rules
- k) **Local Production:** Production of semen from different breeds of species either at public or private level in Punjab
- l) **Proven breeding male:** A donor male of any species declared positive for its genetic performance through progeny testing program/molecular techniques.
- m) **Quality Control:** A reliable system for analysing and ensuring the quality in a manner prescribed under the rules
- n) **Quarantine:** A site or premises provided for the isolation and examination of an animal
- o) **Registrar:** An officer of Livestock & Dairy Development Department appointed by the competent authority having the qualification/experience prescribed under the rules framed under this Act.
- p) **Registration:** To get registered the animals, Semen Production Units and Artificial Insemination Service provides with the office of the Registrar.
- q) **Semen Collection:** A process for harvesting semen from a donor breeding male through artificial means.

- r) **Semen Production Unit (SPU):-** A place where semen is produced for use in Artificial Insemination in the manner prescribed under the rules.
- s) **Semen Quality Checking Committee:** A committee constituted by Registrar for checking of semen quality according to the laid down standards
- t) **Semen:** The male sperm and fluids produced in the testicles and other glands of the male's reproductive system.
- u) **Species:** A group of related animals belonging to the same biological species which can freely interbred to produce fertile progenies
- v) **Test/Candidate Breeding male:** A donor breeding male of any species not yet proved for its breeding values
- w) **Veterinarian:** A Veterinary graduate with minimum qualification of D.V.M., or equivalent qualification and duly registered with Pakistan Veterinary Medical Council (PVMC) working at semen production unit.

Chapter-2

CREATION OF LIVESTOCK BREEDING CONTROL UNIT

3. This unit will be established by the Government of the Punjab, Livestock & Dairy Development Department (L&DDD) duly approved by authority. The maintenance and operation will be supervised by a Registrar designated by the Government having the approved qualification and experience as determined by rules.

Chapter-3

REGULATIONS FOR SELECTION OF BREEDING ANIMALS

4. All the rules & regulations, (standards) for selection of breeding animals to be framed by the Govt. of the Punjab for the execution of this Act such as:
- a. Selection parameters for male breeding animals
 - b. Parentage confirmation of breeding males before entry at SPU or for any breed improvement program.
 - c. Animal registration and milk recording for identification of bull mothers and test mating under Progeny Testing Program (PTP).

Chapter-4

REGULATION FOR SEMEN PRODUCTION UNIT

5. All the rules & regulations, (standards) for Semen Production Unit to be framed by the Govt. of the Punjab for the execution of this Act such as:
- a. Conditions applicable to Semen Production Unit;
 - b. Requirements for Semen Production Unit;

Chapter-5

GUIDELINES FOR USE OF FROZEN/LIQUID SEMEN AND NATURAL MATING

6. All the rules & regulations, (standards)/Guidelines for Use of Frozen/Liquid Semen and Natural Mating to be framed by the Govt. of the Punjab for the execution of this Act such as:
- a. Semen handling and Artificial Insemination
 - b. Natural Mating
 - c. Breeding Policy in vogue. A breeding policy to be designed and approved by the Government for the conservation of local pure breeds of livestock and improvement of Genetic potential of livestock for implementation/execution of this law.

Chapter-6

RULES FOR TRAINING AND GUIDELINES FOR ARTIFICIAL INSEMINATION TECHNICIANS / TECHNICAL STAFF

7. All the rules & regulations, (standards)/guidelines for eligibility criteria, duration of training, training institutions and registration of artificial insemination service providers to be framed by the Government of the Punjab for the execution of this Act.

Chapter-7

REQUIREMENT FOR USE OF EXOTIC SEMEN

8. All the rules & regulations, (standards) for the use of Exotic Semen to be framed by the Govt. of the Punjab for the execution of this Act such as:
- a. Regulations for use of exotic semen
 - b. Specifications for exotic semen

Chapter-8

ADMINISTRATION & ENFORCEMENT

9. **Registrar:** Any officer having prescribes qualification/experience to implement all the rules and regulation framed under this Act.
10. **Appellant Board:** Any person aggrieved by any decision of registrar may prefer appeal to the Appellant Board. Government of the Punjab shall constitute an Appellant Board for the disposal of appeals preferred under the Law. All legal and codal opportunities (notices, show cause and hearings) will be provided to all Appellants/ aggrieved as provided in Law. However legal procedure and formalities are placed in the rules. The aggrieved can file an appeal against the decision of the board in Court of Law /tribunal.
11. **Recruitment/Adjustment of staff:** Government of Punjab may recruit/ transfer from the other wings/ can adjust the required staff (Technical/managerial) as per requirement

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- 12. Funds/Budget:** Necessary funds/ budget for creation of unit and operational expenses for carrying out the purpose will be provided by the Government of Punjab, L&DD, Department as per requirement.
- 13. Registration of Semen Production Units/ Labs/Firms (Public & Private):** All the SPU's public/private sector will apply for a registration and after qualifying the criteria will be registered and list of registered SPU's labs and firms will be published by the provincial Government.
- 14. Registration of Artificial Insemination Service Providers/Concerns/Lab Technician/Technical Workers (Public/Private).**Registration of all artificial insemination service providers, experts, Veterinarian, Technician etc will be done and maintained by the registrar.
- 15. Registration of Breeding males:** All the SPU's in the province will get register their breeding (candidate/proven) males with the Animal Breeding Control Unit of the Government of the Punjab.
- 16. Registration of Agencies:** All SPU's /firms /agencies will got register their sponsoring agencies /donor agencies involved in breeding practices within the country and out of the country.
- 17. Power to Make Rules/Amendments:** The Government may, by notification in the official gazette to make rules/amendments for carrying out the purpose of this Act.
- 18. Printing of Forms / Applications / Proforma :** Government will print applications, forms, and other necessary special designed forms, proformas of different diseases, record and other printing material etc. and will be provided to all applicants.
- 19. Appointment of Government Analyst/Experts:** The Provincial Government may notify in official gazette the appointment of such persons as it think fit having prescribed qualification to be provincial analyst/experts or the case may be.
- 20. Appointment of Inspector:** The Provincial Government may by notification in the official gazette appoint such person as it think fit, having the prescribed qualification as designated inspector except that who has any financial interest in the processing of semen, its import, export, sale etc.
- 21. Appointment / Duties of Semen Inspector:** An inspector may within local limits for which he is appointed, and in any other area within the permission of the licensing authority/Government. Duties of inspector will be designed / framed by the department in prescribed rule for the execution of this law.
- 22. Appointment of Public Analyst (Duties/Powers):** A public analyst will be appointed by the authority /Government. The rules for eligibility of analyst, duties/power of analyst will be designed in prescribed/ approved rule by the Government.
- 23. Power to give Licensing:** All the registered firms, SPUs, laboratory, artificial insemination service provider, traders/person and all other concerns will get license from the Registrar as per criteria laid by the Government in the Rules.

24. Cancellation or Suspension of License and Its Renewal: Where any person found to have been contravened any of the provision of this Act, as the case may be, after giving an opportunity of being heard, License issued to such person be cancelled or suspended for specified period. Any aggrieved person can file an appeal / representation before the Appellant board or other legal forum in the eye of Law after doing all the legal proceedings.(ii). The suspension of license made by Provincial authority/Quality control unit shall on expiry of specified period cease to have effect unless it is extended or continued by the registrar.

25. Registration Fee / Renewal Fee: Government may fix a special amount as fee for Registration of concerned firms / Service providers/Enterprises/ person/Experts as well as a renewal fee for the purpose after expiry of License after a specific period.

26. Certificate of ownership: Authority will issue a certificate of ownership to any person/enterprises/SPU/Bull/Animal/ trader/seller/manufacture etc.

Chapter-9

PENALITES & PROCEDURE

27. Penalties: (1) If any person contravenes any order made under this Act Ibid, he shall be punished with imprisonment for a term which may extend upto one year, or with fine up to one Lac, or with both and, if the order so provides, the Tribunal/court shall direct that any property in respect of which the Tribunal/court designated is satisfied that the order has been contravened shall be forfeited to the extent of Government/Company/ Farm / SPU unless for reasons to be recorded in writing.

1. Violation against standards of Bull Selection for SPU/breeding purpose.
2. Violation against testing, vaccination and quarantine.
3. Violation against standards for housing and bull management.
4. Violation against standards for semen laboratory, semen collection & processing.
5. Violation against standards for cleanliness hygiene and sterilization.
6. Functioning of SPU/firm/enterprise/Artificial Insemination service provider/expert etc. without registration.
7. Violation against regulations for SPU.
8. Use of unapproved bull, storing/possession of below standard semen.
9. Violation against use of frozen/liquid semen and natural mating.
10. Violation against training and guidelines for A.I. Technician
11. Violation against standards for import of semen.
12. Sale of unauthorized semen will be liable to penalty.
13. Unauthorized storage/sale of Semen.
14. Misleading Advertisement.
15. Punishment for obstructing or in personating an official person..
16. Un-hygienic Semen Transportation.
17. Violation in specification of SPU/Lab.
18. Selling of Dead/Sub Standard Semen.
19. Processing of Semen on Unregistered firm/SPU/enterprises/herd/farms.
20. Violation in Breeding Policy (Invoke) by Govt. of the Punjab.
21. Indiscrimination use of Semen for Cattle and Buffalo Breeding in Violation to Breeding Policy (Invogue).

Explanation: Any person/Enterprises (Public or Private) who/that himself or on his or her behalf will violate any principle/parameters of legal use of semen as per breeding policy approved, by using indiscriminate and illegal use of semen according to the breeding policy invoke and law, intentionally or unintentionally, dishonesty and melafidely as per

prescribed/approved rules by the Government of the Punjab in all above serial (1 to 21) violations will be liable to penalized up to Rs. 100000/- (one lac) or imprisonment extended up to one year or both, Government may cease the premises according to the situation.

28. Attempts and abetments: Any person who attempts to contravene or abets the contravention of any order made under this Act shall be deemed to have contravened that order.

29. Offences by corporation: If the person contravening an order made under this Act Ibid is a Company or other corporate body, every director, manager, secretary or other officer or agent thereof shall, unless he proves that the contravention took place without his knowledge or that he exercised all due diligence to prevent such contravention, be deemed to be guilty of such contravention.

30. False statements: If a person:

- (i) When required by an order made under this Act to make any statement or furnish any information, which is false in any material particular and which he knows or has reasonable cause to believe to be false, or does not believe to be true; or
- (ii) makes any such statement as aforesaid in any book, account, record, declaration, return or other document which he is required by any such order to maintain or furnish;

He shall be punished with imprisonment for a term which may extend to one year or with fine up to one lac or with both.

31. Trials by Tribunal/Court: An offence punishable under this Act Ibid shall be exclusively triable by a Tribunal/Special Court designated/ constituted under this Act.

32. Constitution of Tribunals: (1) The Government may by notification, constitute, for the whole or any part of the Province, one or more Tribunals/special court/civil court consisting of a person who.

- (a) has, to his credit, at least ten years practice as an Advocate or any Civil judge/First class Magistrate etc; or
- (b) has, for a total period of not less than three years, exercised the powers of the First Class Magistrate under the Code; or
- (c) is and has for a period of not less than ten years been in the service of Punjab Government and is a law graduate and having in line experience.

(2) The Government shall appoint a person as presiding officer of a Tribunal/Court who is eligible under this Act. (3) A Tribunal/Court shall sit at such place as the Government may, by notification, specify.

33. Powers of Tribunals/Court: A Tribunal/Court may pass any sentence and exercise all or any of the powers which a Magistrate of the First Class empowered under section 30 of the Code or designated may pass or exercise under the code.

34. Appeal: (1) A person, sentenced by a Tribunal/Court, may appeal to the Court of Sessions having jurisdiction in the area, within thirty days of the passing of the sentence order.

35. Offences and procedure: (1) An offence under this Acts shall be cognizable and bail able compoundable. (2) The procedure for not compoundable the trial of offences under this Act shall be the same as is laid down in the Code for trials on the basis of report or complaint submitted in the Tribunal/Court under the Code/Act. (3) Nothing in this section shall preclude a Tribunal/Court

to follow the procedure laid down in the Code for the trial of summons cases by the Magistrates.

36. Bar of jurisdiction and reference to arbitration: (1) No order made in exercise of any power conferred by or under this Act shall be called in question in any Court. (2) Save any order passed by a Tribunal/Court under this Act, any person aggrieved by an order made in exercise of any power conferred by or under this Act, may by an application in writing, within thirty days of the passing of the order, refer the matter to the arbitration of a sole arbitrator appointed by the Government. (3) The Government shall appoint one or more arbitrators for all cases or different arbitrators for different classes of cases under this Act. (4) All suits, appeals or applications regarding matters to which this Act applies, pending in any Court, except an appeal against an order preferred to the Court of Sessions, shall abate. (5) A reference to arbitration under this Act in respect of such orders as were subject-matter of a suit appeal or application which abated under this Act may be made to an arbitrator within thirty days/or the time given by the Government of the coming into force of this Act.

37. Presumption as to orders: Where an order purports to have been made in exercise of any power conferred by or under this Act, the Tribunal/Court shall presume that such order was so made.

38. Burden of proof in certain cases: Where any person is prosecuted for contravening any order made under this Act which prohibits him from doing an Act or being in possession of a thing without lawful authority or Without a permit, license or other document, the burden of proving that he has such authority, permit, license or other document, shall be on that person.

39. Protection of action taken under the Act: (1) No suit, prosecution or other legal proceeding shall lie against any person for anything which is, in good faith, done or intended to be done in pursuance of any order made under this Act. (2) No suit or other legal proceeding shall lie against the Government for any damage caused or likely to be caused by anything which is, in good faith, done or intended to be done in pursuance of any order made under this Act.

40. Validation and savings: All policy instructions or directions of the Government issued before the promulgation of this Act which are not contradictory to this Act shall be deemed to have been issued under this Act.

41. Annual report: (1) The quality control unit shall submit annual report of its activities to the Government at the end of a financial year.

(2) The Authority shall circulate a quarterly report of its activities to all the Members/Concern in the prescribed manner.

(3) The Government shall lay the annual report of the Authority in the Provincial Assembly of the Punjab.

42. Act Ibid to have overriding effect: Notwithstanding anything inconsistent contained in any other law, the provisions of this Act and any order made under this Act shall have overriding effect over all other laws.

43. Power to make rules: (1) The Government may make rules for carrying out the purposes of the Act. (2) In particular and without prejudice to the generality of the foregoing provision, such rules may provide:

(a) The manner of keeping of accounts of the Government.

(b) Qualification and procedure to be followed for appointment or recruitment of advisers, consultants, experts, technical Staff, Inspector, Analyst officers and other employees of

the Government as laid down by the competent authority.

- (c) Terms and conditions of employment or service of the employees of the Government.
- (d) Date on which and the form in which the annual budget statement unit shall be submitted to the Government each year.
- (e) Procedure for appropriation and re-appropriation of moneys at the disposal of the Breeding Quality Control Unit by Government/Authority.
- (f) Form and manner in which the accounts of receipts and expenditure of the Government shall be kept.
- (g) Manner and form in which and the unit/Authority/Government to whom returns, reports, or statements shall be submitted.
- (h) Establishment, composition, powers and duties of various committees which may be established under the Act.
- (i) Such other matters relating to the administration and other affairs of the Unit as the Government may think fit to be prescribed by rules approved by the government.
- (j) Manners of Government/ Unit by which account of the unit shall be audited.
- (k) Manner in which audit reports should be submitted by the Government/unit.

44. Power to frame regulations: This may, with the approval of the Competent Authority, frame regulations for matters not provided in the rules for which provision is necessary or expedient for carrying out the purposes of the Act.

45. Transition: All matters relating to the semen processing initiative of the Government shall be transferred to the Quality Control Unit/Government of the Punjab, through a notification to, be issued under this Act, by observing all legal formalities.

Chapter-10

MISCELLANEOUS

46. Jurisdiction Barred: Save as provided under this Act, no order made or proceeding taken under this Act, or the rule made there under, shall be called in question in any court or no Injunction shall be granted by any court in respect to any decision so made or proceedings taken on pursuance of any power conferred by, or under this Actor the rule made there under.

47. Delegation: Government may delegate all or any of its power and function under this Act to any authority or officer by name or designation.

48 . Grant of permission for special purpose: A special permission will be accorded for special purpose by authority/Govt. as required by the stakeholders.

49. Probation of products of non-registered breeders / SPUs / Etc: A probation/strict observations will be hold on non-registered breeders SPUs/Labs/concerns for the purpose, or the case may be.

50. Appearance through Counsel or Advocate: Can appear in person or through counsel and authorized representation by company enterprises/party etc.

51. Jurisdiction: Appeal before any Civil Court or any 1st Class Magistrate/ Judge or any special Magistrate or any tribunal, Member of tribunal as the case may be declared by the Government.

52. Proceeding under this Act: Subject to Act all proceedings initiated against any person/Co./enterprises/SPU/farm (Public / Government) shall be govern by this Act/ Amended Act 2010.

53. Indemnity: No suit / prosecution or other legal proceedings shall be against any informer, staff member, officer, the complainant etc. Authority for any reason thing done or intended to done in good faith under this Act, directions can be made or issue any time as per rules laid down by the Government in this regard.

54. Power to Make Regulation/ By laws/Standards: Government may by notification or any gazette make rules further/supplementary for carrying out purpose of Act through framing regulation, by Laws/standards for execution of Act.

55. Amendments / Revision / Revival of Act: Government may notify / any amendment, revision at any time after the approval of competent authority for carrying out the purpose of this Act.

56. Power to Amend Schedule: The Government of Punjab may, by notification in official gazette, amended schedule so as to add any entry there to or modify or omit any entry there in.

57. Removal of Difficulties: If any difficulty arises in giving effect to any provision of this Act, the Chief Minister, Punjab, make such order to the provision of this Act, as any approval to him to be necessary for this purpose of removing difficulties.

58. Repeal: The “Punjab Livestock Breeding Act-2011” will be repealed with any other approved Act in this regard by the competent Authority / Government, of the Punjab.

Dated:

MINISTER FOR LAW & P.A.

Appendix B: Proposed Functional Structure of the PLGIC (for discussion)

Functional structure of the PLGIC for discussion

The PLGIC will consist of the following units

1. Animal identification and traceability unit (jointly with the veterinary department)
 - It should establish national standards for an animal identification scheme, attributing unique numbers to farms and animals and monitoring animal movement.
 - All cows on a farm participating in the pedigree and performance recording programme should be registered.
 - If possible, also cows and buffaloes included in AI (not only the ones in the PPRS) should be included.
2. Animal field recording unit
 - Organization of the monthly recording
 - Recruitment and supervision of recorders
 - Data transfer to the data management unit
 - Feedback to farmers
 - AI recording.
3. Milk analysis laboratory
 - Analysis for fat and protein
 - Somatic cell count
 - Possible: urea and others.
4. Data management unit
 - Data processing
 - Feedback to farmers and SPU or AI centres
 - Calculation of breeding values
 - Identification of bull dams
 - Progeny testing of bulls.
5. Conservation unit, dealing specifically with conservation and the development of local breeds.

Suggested mechanism to finance the PLGIC

The PLGIC should be financed by:

- SPUs
- Breeders' organizations
- Government - because there is a public good component that justifies the support
- (At a later stage) Breeders' organizations - because they are direct beneficiaries of the services.

Possible fee structure:

- One-time capital entrance fee for SPU and breeders' organizations.
- Annual fixed fee that is the same for each SPU and breeders' organization.
- Fee per AI performed
- Levy on AI doses imported.

Appendix C: List of Meetings

Name	Designation	Organization
Dr Adnan Ali	Manager (Dairy and Livestock)	Small & Medium Enterprise Development Authority (SMEDA)
Imran Chaudry	Manager (Donor Coordination and International Linkages)	Small & Medium Enterprise Development Authority (SMEDA)
Naureen Anjum	Assistant Manager Dairy & Livestock Sector Development	Small & Medium Enterprise Development Authority (SMEDA)
Ashfaq Ahmed	Provincial Chief, Punjab	Small & Medium Enterprise Development Authority (SMEDA)
Altaf Mahmood	Chief Executive	Altaf & Co (Rep of World Wide Sires, USA)
Sheraz Chaudry	Managing Director	Sheraz Enterprise (Semen Producer)
Ch. Hamid Malhi	Director	Livestock Farmers & Breeders Association
Prof. Dr. Talat Naseer Pasha	Vice Chancellor	University of Veterinary and Animal Sciences (UVAS)
Khalid Awais Ranjha	Additional Secretary	L&DD Department
Dr Muhammad Nasir Javed	Director BIC	University of Veterinary and Animal Sciences (UVAS)
Haroon Mahmood Khan Lodhi	CEO	SOLVE AGRIPAK
Hafiz Wasi Muhammad Khan	Head of Farm & Agri Division	SOLVE AGRIPAK
Maj Gen Muhammad Ali Khan	CEO	PLDDB
Dr Naveed Niazi	GM Field Services & Capacity Building	PLDDB
Shahzad S. Iqbal	CEO	Jassar Farms
Dr Javed Iqbal	Director	RCCSC
Dr Muhammad Irfan Zahid	DG Extension	L&DD Department
Dr. Sajjad Khan	Professor Genetics	University of Agriculture, Faisalabad
Dr Tasneem Akhtar	Director Breed Improvement	L&DD Department , Government of Punjab
Dr Nawaz Saeed	Principal Research Officer	BRI
Dr Mustaq Ahmed	Research Officer	LPRI
Dr Manzoor Ahmed	Research Officer	BRI

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