



Dr Hans Gerhard Wagner's End of Mission
Report

Reforming the Breed Improvement System of Punjab

Livestock and Dairy Development Department

Punjab Government Efficiency Improvement Programme

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Final



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List of Abbreviations

BRI	Buffalo Research Institute
LPRI	Livestock Production Research Institute
PGEIP	Punjab Government Efficiency Improvement Project
PPRS	Pedigree and Performance Recording Scheme
RCCSC	Research Centre for Conservation of Sahiwal Cattle
SPU	Semen Production Unit

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1. Introduction

In line with the Priority Reform Implementation Plan agreed with the Livestock & Dairy Development Department in June 2011, PGEIP consultants supported the Departments with reform and modernisation efforts in the breed improvement area.

Dr Hans Gerhard Wagner provided a set of recommendations based on the findings of a situation analysis of the breed improvement field, which was conducted during his first visit to Lahore in January 2012. The first mission led to the conclusion that, to stimulate broader discussion on the need for action towards genetic improvement, conclusions and recommendations should be presented to an audience of technical experts and the private sector in one or two workshops. The forums would also give the opportunity of refining the recommendations and make them more practical and suitable to the local context. The report suggests far-reaching changes and increased responsibilities within the private sector, which so far has acted independently and remained uncontrolled. A summary of the conclusions of the situation analysis is given in Appendix I.

In response, two workshops were indeed organized; the first largely involved technical experts and representatives from the universities in Lahore and Faisalabad, the four research institutes (BRI, the LPRI, the RCCSC and the PRC) and from government departments. The first workshop was aimed at reaching a general agreement among the technical experts on the soundness and feasibility of the proposed activities that would create a solid and technical basis for the discussion with the private sector representatives. A more detailed description of the workshop's objectives is provided in Appendix A.

The agreed-on technical requirements for a genetic improvement programme for cattle and buffalo for Punjab were then presented to the private sector participants in the second workshop to stimulate their feedback. Included in that discussion were some of the technical experts and representatives of the private SPUs, the Punjab Livestock and Dairy Development Board, breeders' associations and societies for buffalo and cattle as well as the Small and Medium Enterprise Development Association dealing with livestock importation and other private companies dealing with semen and livestock imports.

Both groups of workshop participants were not as broad as intended due to conflicting events in the livestock sector in Lahore and Faisalabad; nevertheless, it was considered broad enough to fully and sufficiently reflect the sector.

2. Breed Improvement Workshops

2.1 First Workshop

The first workshop took place on 15 March 2012 at the Management and Professional Development Department.

Dr Tasneem Akhtar, Director Breed Improvement of the Livestock and Dairy Development Department, opened the presentations with her comments on the importance of breed improvement in dairy sector competitiveness in Punjab. Dr Tasneem pointed out that Pakistan is the fourth-largest milk producer in the world, at 35.5 million tons, following India, the largest producer, at 112.7 million tons annually, the United States, at 87.5 million tons and China, at 39.1 million tons.¹ Punjab, with 20.61 million buffalo and 17.44 million cattle,² produces 28.4 million tons of milk. In terms of competitiveness, Pakistan is far behind the leading countries. The increase in milk production from 2010 is almost exclusively attributed to an increase in animal numbers rather than individual animal productivity. To put figures into context, one cow in New

¹ FAOSTAT

² LDDD 2012. *Economic survey of Pakistan 2011*. Islamabad, Livestock and Dairy Development Department.

Zealand or in the United States produces as much milk as three and seven cows, respectively, in Punjab.

Dr Tasneem stressed that a robust breed improvement programme would need to focus on identifying superior genetic material supported by improved management, feeding health and reproduction. In Punjab, the gap between the availability of and the requirement for the total digestible nutrients (TDN) of 21.36 metric tons, or 24 percent, indicates the need to replace the less-productive animals with more-productive animals.

Generating more milk from the same number of animals can only be achieved with genetic improvement. Historically, this has been done elsewhere - for example in the United States, where, in 1930, 22 million cows produced 45 million tons of milk, or 2,049 kg per cow. By 1992, only 9.8 million cows produced 69 million tons of milk, or 7,000 kg per cow. There is clear indication of the genetic potential among buffalos and Sahiwal cattle in Punjab that such an increase is possible: in milking competitions, buffalo were found with a 24-hour production of 28.0 litres and Sahiwal cows with a production of 29.4 litres of milk. **Genetic improvement, based on a pedigree and performance recording scheme, would improve the productivity and competitiveness of the local dairy animals.**

Sajjad Khan, Professor in Animal Breeding and Genetics at the University of Faisalabad, spoke next. Attributing the dramatic increase in the productivity of dairy cattle in the United States, which started sometime around 1960, to the computerization of dairy records in 1950 (it takes about ten years for a genetic improvement programme to show tangible differences). The use of sophisticated statistical models, starting with a contemporary comparison (CC), followed by best linear unbiased prediction (BLUP) and animal models, allowed for the accurate bull selection and progeny testing. This (tested) superior genetic material was spread through the populations on a broad scale with artificial insemination.

The Sahiwal cattle, a unique genetic resource, originated from Pakistan and are found all around the globe in tropical environments as well as in Australia and Kenya. Analysis of the breeding work that has been done in Pakistan to date suggests that there has been essentially no increase in the phenotypic trend in milk yield since 1971. Thus, there has been no improvement in productivity.

In 2003, Professor Khan requested a livestock action plan and a breeding policy for Pakistan. At that time, livestock production was mainly the task of the veterinary services and very much centred on veterinary service delivery, with genetics given little or no importance. Professor Khan thinks that genetics should take centre stage and the veterinary care, herd management, feeding reproduction, and marketing aspects should have supporting roles. He remarked that the whole structure for improving the country's livestock needs reshaping, with breed improvement as only one segment, but he questioned whether there is sufficient political will to make the necessary changes.

In his presentation on genetic improvement, Dr Hans Gerhard Wagner enumerated the reasons why genetic improvement of Pakistan's livestock is imperative. The increased output of milk and meat over the past few decades in developing countries is attributed solely to an increase in animal numbers and not to increases in animal productivity. An expanding and wealthier population demands more food and typically changes its consumption habits from starchy staple food to higher-quality protein foodstuffs of animal origin. If there are no improvements in animal productivity in Punjab, the deficit in the supply of milk will be about 20 percent by 2020, requiring that a province – with all the necessary preconditions otherwise to meet its demand for milk – will have to start importing it. The land and fodder resources are finite, so more milk has to be produced from the same number of animals or, even better, from a smaller number of higher-performing and more productive animals.

There is also the issue that ruminants are responsible for a substantial portion of greenhouse gas emissions. The greenhouse gas emissions and the carbon foot print per kilo of milk and meat can be substantially reduced if the same quantity is produced by the same or a smaller number of animals because the maintenance requirements for a poorly and a highly productive animal are the same. As well, highly productive animals are more profitable to farmers, and farm income can be substantially increased.

Dr Wagner believes it is not possible to sustain dairy development without a supporting genetic improvement programme. A pedigree and performance recording scheme is the basis for any genetic selection scheme.

A PPRS provides the necessary information for the best choice of breed for a given environment. Not every breed performs the same in every environment. Additionally, no genetic improvement is possible without a PPRS because no superior producing dams can be objectively identified, and consequently no bulls of genetic quality can be selected for the SPUs and, later on, progeny tested. The PPRS is an indispensable tool for large-scale farmers to make management and selection decisions. As well, the PPRS provides quality data for extension services and policymakers.

Genetic improvement is a slow process, with only a small increment of 1–2 percent change of the mean. But genetic improvement has several other remarkable properties: Genetic progress is *permanent*; after one cycle of selection, the improvement is anchored in the genome and passed on from generation to generation. Such change is unlikely through feeding because although animals respond to better feeding immediately, they drop back to their old genetic level once the improved feeding discontinues. Genetic progress is *cumulative*; a genetic improvement programme does not stop after one selection cycle. Rather, progress is added on year after year. Genetic progress is *multiplicative*; the most powerful tool for the rapid and broad distribution of genetic progress is artificial insemination. The advantage for Punjab is its well-developed AI service, which unfortunately is not based on a genetic improvement programme, so the bulls in the SPUs at best can be considered only as random.

In a second presentation, Dr Wagner summarized the outputs of the situation analysis carried out in January 2012. He then discussed the key steps for improving the genetic potential of livestock in Punjab: The basis for any action is a legal and policy framework. A draft breeding law exists in Pakistan and needs to be finalized and enacted before any activity can start. Breeding objectives and strategies for the different cattle and buffalo breeds and for their sustainable development have to be established and publicized. Such policies and strategies are guidance documents only, however, while the breeding law components are enforceable, which is why it is critical.

The breeding law must clarify amongst others the standards for the SPUs (structure, hygiene, management and processing requirements accreditation), the AI technicians (training duration and accreditation), and the genetic quality of test bulls used in artificial insemination and their progeny testing.

Additionally, there must be a clear definition of what is a private good and what is a public good in breed improvement activities. **The role of the public sector is to set the standards for the private sector, monitor them, and provide subsidies and support if necessary in the public's best interest.**

Dr Wagner suggested phasing out government involvement in semen production and AI services. He believes the private sector should be the primary actor in establishing a genetic improvement programme that is based on a sound pedigree and performance recording scheme. The laudable activities of the LPRI, BRI and RCCSC in the area of field performance recording should be merged and expanded under private tutelage.

For any increase in animal productivity, a sound PPRS is an absolute requisite. SPUs will only be able to recruit young bulls for known genetic merit if there is a PPRS with a genetic evaluation programme, which is one of several reasons for private sector involvement. Additionally, the private sector needs the PPRS and must become involved in its operation, otherwise it will not be able to meet the government standards for genetic quality and progeny testing of AI bulls.

The large-scale uncontrolled import of exotic germplasm through live animals and frozen semen are taking place currently. However, there is no objective evaluation of the performance of the offspring and no objective evaluation to determine if the imports are really beneficial to the country. In fact, the use of imported exotic germplasm constitutes, through the cross-breeding programmes, a threat to the local indigenous genetic resource.

Dr Wagner also suggested establishing a Punjab Livestock Genetic Improvement Centre, under private management (and in line within a legal framework), to conduct pedigree and performance recording and the necessary milk analysis and maintain the central database for all dairy and

beef cattle and buffalo in the province. The genetic analysis would be considered a public good and would have to be conducted or financed by the public sector.

He also suggested that the genetic improvement centre operates with a board and technical advisory committee. The board is responsible for the management of the PLGIC while the advisory committee would provide technical support in breeding matters when necessary and appropriate to meet the changing requirements.

In the medium term, the 15,000 buffalo and cattle under recording currently with the BRI and the RCCSC should increase to 50,000 each, in a time frame of five years. This is considered the minimum number of cows under performance recording needed for the Punjab AI service to recruit annually the required number of test bulls and to progeny test them with about 75 daughter lactations per test bull. In industrialized countries' progeny testing programmes, more than 100 daughter lactations are required, but 75 are considered sufficient for an acceptable level of accuracy.

Dr Wagner believes that the livestock and dairy are major sectors for the growth of Punjab's economy. To better and fully exploit the potential, a legislative framework and a policy and strategy is required for livestock and dairy development. The private and public sector responsibilities need to be clearly defined. The public sector function is seen in setting the standards and regulations and then enforcing them – with possible subsidies if in the public interest. As emphasized, a PPRS under private tutelage is the requisite for any livestock improvement programme.

The presentations stimulated a lively discussion among the participants leading to the endorsement of the recommendations based on the findings of the situation analysis and to the following conclusion:

- If Punjab wants to unlock the potentials of the livestock sector for economic growth, the Province requires:
 - A solid regulatory framework (Breeding Act) that reflects a consistent breeding policy;
 - A breed-improvement strategy, based on clear goals for all species;
 - Strong, empowered breeders' organizations, societies and associations;
 - Standards and procedures based on international good practices to regulate the market (SPUs, recruitment of test or candidate bulls and progeny testing, AI technicians and their training, natural mating bulls, semen and live animal imports).
 - A clear allocation of responsibilities between public and private entities in the breed improvement field, with the Government setting and overseeing the regulatory framework and subsidising the private sector where appropriate and necessary in the public interest;
 - A private sector that is leader in the delivery of AI services and semen production;
 - A pedigree and performance recording scheme for the selection and genetic improvement, implemented by a technically and professionally sound independent and financially autonomous entity led and governed by private sector parties - including breeders' associations, farmers and SPUs, with support of public funds if necessary.

2.2 Second Workshop

The workshop took place on 18 March 2012, also at the Management and Professional Development Department. A number of invitees were unable to attend partly because the workshop coincided with an important event chaired by the Chief Minister of Punjab - announced at short notice – and partly for other reasons. Although a broader participation would have been desirable, the private sector had a sufficient representation to express the views of the sector. Tasneem Akhra and Sajjad Khan delivered the same presentations as in the first workshop. Hans Gerhard Wagner combined his two presentations.

Muhammad Farooq, consultant for the AI Haiwan Sires, one of the biggest SPU in Punjab, covered the private sector expectations on breed improvement. He divided Punjab's livestock history into three periods: Until 1970, 70 percent of the national cattle were used for draught and only 30 percent for milk. Natural breeding with bulls of different breeds was practised. In 1972–1980 and under the Qadirabad project, AI technology was introduced to boost milk production. Friesian bulls were introduced and used with bulls of local breeds. From 2000 to 2011, private

SPUs entered the market. The SPUs have generally poor laboratory standards, there is no check for venereal diseases and the bulls are non-pedigree, so of little or no genetic value. For that reason, milk productivity has not increased.

Mr Farooq commented that the role of the private sector is to provide awareness programmes and extension services to farmers. AI service could be made more attractive to farmers by delivering it to their doorstep – the government does not deliver AI services to the doorstep and farmers must take animals to the vet clinic. Private AI technicians should make available semen from exotic breeds for cross-breeding of non-descript breeds and semen of locally defined breeds for their improvement.

Mr Farooq further stressed that minimum laboratory standards for SPUs are required and that the Government should license the SPUs. A central monitoring unit should monitor the SPUs so that only semen of good quality is used. This would also help protect farmers who otherwise are charged for substandard service.

A standard for minimum genetic quality for AI bulls has to be established and adherence supervised by the Government. ISO certification of SPUs could improve farmers' trust in the AI delivery scheme.

Mr Farooq also recommended that training courses for AI technicians should be standardized to guarantee quality service delivery to farmers.

In conclusion, he stressed the necessity of a PPRS (he called it a field performance recording) to allow the recruitment of young bulls of known genetic quality and to undertake the necessary subsequent progeny testing.

Asad Zahoor presented the conclusions of the first workshop and facilitated the subsequent lively discussion. The need to bring about changes to meet the challenges of the future was fully recognized as well as the fact that action has to start immediately. Action is needed to safeguard and develop the valuable local genetic resources, to monitor the influx of exotic germplasm, to protect farmers and to meet the population's requirements for milk and meat.

Participants agreed with the findings and the recommendations and endorsed the conclusions of the first workshop.

A major question, however, remained unanswered: who is going to take action and take the lead?

3. Road Map for the Establishment of a Genetic Improvement Programme

At the end of the assignment, the consultant has developed the following road map for the establishment of a genetic improvement programme for the Punjab Province.

Table 1: Road Map for the Establishment of a Genetic Improvement Programme for the Punjab Province

Year	Activity	Responsible entity
Year 0 2012	Finalization and ratification of the breeding law.	TBC
Year 1 2012	In consultation with the breeders' societies, finalization of the breeding objectives and strategy for: <ul style="list-style-type: none"> ▪ Sahiwal conservation and sustainable development ▪ Cholistani conservation and sustainable development ▪ buffalo ▪ beef breeds, conservation and sustainable development ▪ cross-breeding (semen imports) ▪ import of exotics and their development. Setting standards modalities for accreditation of: <ul style="list-style-type: none"> ▪ semen production units 	TBC

	<ul style="list-style-type: none"> ▪ AI technician training and training institutions. <p>For a private sector managed pedigree and performance recording scheme, establishment of a committee to define:</p> <ul style="list-style-type: none"> ▪ modalities ▪ legal structure ▪ responsibilities ▪ financing. <p>Clear identification of private and public responsibilities.</p> <p>Support in the creation and registration of breeders' associations and societies.</p>	
Year 2 2013	<p>Establishment of the Punjab Livestock Genetic Improvement Centre.</p> <p>Harmonization of the data of the BRI, LPRI and RCSSC in one Punjab-wide central database and the start of the Punjab pedigree and performance recording scheme, based on the animals already under recording: 15 000 Sahiwal cows, 15 000 buffalo and the animals under recording from LPRI.</p> <p>Young AI bulls selected for SPUs, based on the "old" records.</p>	TBC
Year 3 2014	<p>Under recording:</p> <ul style="list-style-type: none"> ▪ 20,000 buffalo ▪ 20,000 cattle <p>First bull dam selection on completed lactation in new programme.</p>	TBC
Year 4 2015	<p>Under recording:</p> <ul style="list-style-type: none"> ▪ 27,500 buffalo ▪ 27,500 cattle 	TBC
Year 5 2016	<p>Under recording:</p> <ul style="list-style-type: none"> ▪ 37,500 buffalo ▪ 37,500 cattle <p>First genetically evaluated test or candidate bull out of the "new" programme enters the SPU.</p>	TBC
Year 6 2017	<p>Under recording :</p> <ul style="list-style-type: none"> ▪ 50,000 buffalo ▪ 50,000 cattle 	TBC
Year 7 2018	<p>Under recording:</p> <ul style="list-style-type: none"> ▪ 50,000 buffalo ▪ 50,000 cattle <p>First AI bull from "old" programme progeny tested by "new" programme.</p>	TBC

4. Punjab Livestock Breeding Act

The Department agrees that the draft Punjab Livestock Breeding Act is not yet a solid piece of legislation. The consultants organized a separate session to discuss this draft law. Comments were provided and examples of breeding laws from other countries were made available.

5. Private Sector Involvement in PPRS

It is recommended that Secretary Livestock and Dairy Development establishes a committee to take forward the private sector involvement in the PPRS. The committee's terms of reference may include the development of a six-month plan to implement the PPRS under a private sector entity with limited government subsidies (Punjab Livestock Genetic Improvement Centre). The consultant recommends that all the following institutions are represented in the committee:

- Punjab Livestock and Dairy Development Board
- University of Faisalabad
- University of Lahore
- Buffalo breeders' association
- Sahiwal breeders' association
- 2 private SPUs
- Livestock and Dairy Development Department

Other stakeholders and technical experts could be invited as observers or to contribute to the discussion, but responsibility to deliver should remain firmly with the committee.

6. Role of Breeders Organisations and Associations

The Secretary Livestock and Dairy Development has established committees for: (i) Sahiwal cattle, (ii) Cross-bred cattle, (iii) Cholistani cattle, (iv) Dhanni, Dajal, Rojhan and other cattle breeds, (v) Nili Ravi buffalo, (vi) Small ruminant, (vii) Horses and asses, (viii) Camel.

Upon request of the Department, the consultant has organised group meetings with representatives of all committees - with the exception of the small ruminants. The discussions focused on three main issues:

1. Role of the breeders' associations and their organization
2. Development strategy for the breeds covered by the respective organization
3. Financing of the breeders' organizations.

Generally, the breeders' organizations are rather weak and lack adequate sources of funding. Their activities are limited to organizing livestock shows and milking competitions. This range of activities is not enough to convince members to financially support the organization. Only if the organizations broaden the range of services they provide to their members will farmers eagerly contribute.

Breeders' associations should take an active role in the development of the breeding goals for their breeds. They should take a clear stand for the development of their breeds. It is the task of the breeders' association to keep the register for their cattle and issue, for a fee, the necessary pedigree certificate. All this, however, is not possible currently without a comprehensive PPRS, which would provide accurate pedigree and performance data. Breeders' organizations should establish livestock markets in which certified animals of their breeds are sold. Particularly important would be the sale of certified bulls for natural mating.

In summary, breeders' associations need strengthening. Targeted government subsidies for supporting a given breed could be channelled through a breeders' association. One example is a heifer prize, which is provided to increase the number of pure-bred animals. A farmer receives a financial bonus if he or she raises a pure-bred heifer and mates her with a bull of the same breed. The premium is paid when the calf is born.

Arrangements were made that the members of the committees receive the FAO documents guidelines for in vivo conservation and breeding strategies for the sustainable management of Animal Genetic Resources (AnGR).

7. Funding a Pedigree and Performance Recording Scheme

This section contains a rough order of magnitude estimate for PPRS – a more accurate estimate about the scheme cost is not possible at this stage.

The calculations are based on the following assumptions:

- The recruitment of animals to the scheme follows the plan in Appendix D. Starting with the 15,000 Sahiwal and 15,000 cattle currently under recording by RCCSC and BRI and reaching 50,000 Sahiwal and buffalo under recording five years after the commencement of the programme.
- The average herd size is eight to ten animals.
- One recorder can cover about 20 farms a month.

The table in Appendix E gives preliminary information about the costs of field recording. After the initial investment in the first year, the largest requirement is the ear tags for the offspring, which are born annually.

The table in Appendix F is an estimation of the costs of conducting a milk analysis. This scenario opts for a decentralized system that uses Lactoscans, starting with five sub-centres in the first year, followed by five in year three and another five in year five. Lactoscans are good instruments and can well serve a genetic improvement programme that is designed to look more at differences than absolute values. However, they are not suitable for milk payment purposes based on fat or protein because they are not precise enough. If the system chosen is centralized, milk samples must travel long distances. This is logistically complicated and involves high costs for the transportation.

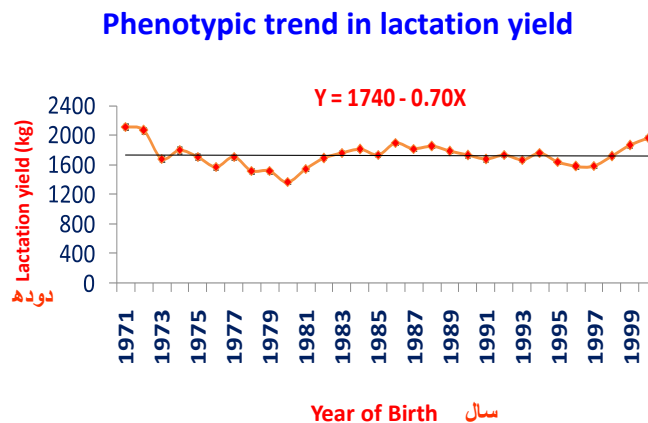
The table in Appendix G provides the estimated investment needed to set up a central data management unit.

The table in Appendix H shows estimated running costs for the genetic improvement scheme under the assumption that the recording costs are about US\$15 per cow per year (this includes the cost of the recorder and the milk analysis). We anticipate the need for about US\$700,000 to cover the start up costs for the first six years. This figure is based on the assumption that an outside organization is contracted to establish the scheme, train the people and provide guidance for the first five or six years until the programme is fully established. The Government may want to attract funds from FAO or other donors to fund this project.

These costs seem very high. It is a long-term investment whose benefits can only be seen after many years – but this is a step to take in order to be prepared for future challenges. **The programme will be expanded through AI to reach millions of cattle and improve the livelihood of millions of farmers.** A very simple analysis of the benefits tells us that if we consider an increase of 50kg of milk per year and 4 million calves born (which could be a medium-term goal) of which 2 million are female, the increase would be 100,000 tons of milk per annum. This increase would be permanent and cumulative.

In order to replace the chart in figure 1, which shows no improvement over almost 30 years...

Figure 1: Phenotypic trend in lactation yield



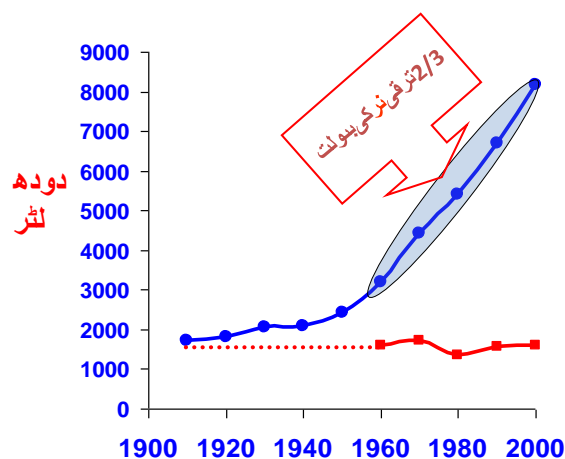
n=9003; \bar{X} = 1729 kg

Bashir (2005)

...with the chart in figure 2, which shows positive development due to consequent genetic improvement and a selection programme...

Figure 2: Why performance recording and bull selection

Why performance recording and bull selection



... the Province requires a pedigree and performance recording programme as the basis of genetic selection.

This has to be accompanied by improved feeding and management, and veterinary service to allow the improved animals to fulfil their genetic potential (figures 1 and 2 are taken from Sajjad Khan's presentation).

Appendix A: Breed Improvement Workshops Concept Note

Objective of the workshops

Further to the situation analysis of breed improvement in Punjab conducted in January 2012, we propose to host two workshops on the subject, with the following general objectives:

- Discuss the findings of the analysis with key parties.
- Reach consensus on the need for breed improvement system to be reformed.
- Raise awareness on the programmes necessary for genetic improvement.
- Discuss the way forward with a focus on the roles of the public and private parties.

First Workshop

The first workshop will focus on the importance of a progeny testing scheme, based on a sound pedigree and performance recording system for breed improvement in Punjab.

Specific Objectives

Reach consensus on the need for a pedigree and performance recording programme, leading to genetic improvement.

Identify the role of public sector and research institutes in genetic improvement programmes.

Participants

The number of participants should be around 20 from the Livestock and Dairy Development Department, research institutes, academic institutes, possibly including some representatives from major associations in the sector.

Date and venue

The half day workshop will be 15 March 2012 at the Management and Professional Development Department.

Second workshop

The second workshop will focus on the importance of breed improvement for dairy and meat sector competitiveness.

Specific Objectives

Discuss the conclusions of the first workshop with key parties from the private and public sector.

Identify the role of the private sector in genetic improvement programmes in the Punjab Province.

Participants

The number of participants should be around 50 from the Livestock and Dairy Development Department, research institutes, academic institutes, major associations and private parties in the sector.

Date and Venue

The workshop will be 18 March 2012 at the Management and Professional Development Department.

Appendix B: Workshops Agenda

Workshop**Importance of Progeny Testing Scheme based on a sound Pedigree and Performance Recording System for Breed Improvement in Punjab***March 15, 2012**Management and Professional Development Department (MPDD), Lahore*

Start Time	End Time	Description
09:00	09:15	Arrival
09:15	09:20	Recitation from Holy Quran
09:20	09:30	Welcome Address by Director PRMP
09:30	09:45	Introduction to PGEIP Project
09:45	10:00	“Importance of Breed Improvement for Dairy Sector Competitiveness in Punjab” By Dr Tasneem Akhtar, Director Breed Improvement L&DD Department, Government of Punjab
10:00	10:20	Review of Past Experiences in Genetic Improvement of Sahiwal and Buffalos in Punjab By Dr Sajjad Khan, Professor University of Agriculture, Faisalabad
10:20	10:40	Tea Break
10:40	11:20	Basics of Genetic Improvement By Dr Hans Wagner, Breed Improvement Expert, PGEIP Project
11:20	11:40	An Analysis of Current Situation and Proposed Way Forward for Progeny Testing Scheme based on Pedigree and Performance Recording System for Punjab By Dr Hans Wagner, Breed Improvement Expert, PGEIP Project
11:40	13:20	Interactive Session
13:20	13:30	Concluding Remarks by Mr. Hamid Yaqub Sheikh, Secretary Livestock & Dairy Development, Government of Punjab
13:30		Lunch

Workshop
Importance of Breed Improvement for Dairy and Meat Sector Competitiveness
-The Way Forward

March 19, 2012

Management and Professional Development Department (MPDD), Lahore

Start Time	End Time	Description
09:00	09:15	Arrival
09:15	09:20	Recitation from Holy Quran
09:20	09:30	Welcome Address by Director PRMP
09:30	09:45	Introduction to PGEIP Project
09:45	10:00	“Importance of Breed Improvement for Dairy Sector Competitiveness in Punjab” By Dr Tasneem Akhtar, Director Breed Improvement L&DD Department, Government of Punjab
10:00	10:20	Review of Past Experiences in Genetic Improvement of Sahiwal and Buffalos in Punjab By Dr Sajjad Khan, Professor University of Agriculture, Faisalabad
10:20	10:40	Tea Break
10:40	11:00	Private Sector Expectations on Breed Improvement in Punjab
11:00	11:20	Basics of Genetic Improvement By Dr Hans Wagner, Breed Improvement Expert, PGEIP Project
11:20	11:40	Conclusions and Recommendations from “Importance of Progeny Testing Scheme based on a sound Pedigree and Performance Recording System for Breed Improvement in Punjab”
11:40	13:20	Interactive Session
13:20	13:30	Concluding Remarks by Mr. Hamid Yaqub Sheikh, Secretary Livestock & Dairy Development, Government of Punjab
13:30		Lunch

Appendix C: Workshops Participants

Importance of Progeny Testing Scheme based on a sound Pedigree and Performance Recording System for Breed Improvement in Punjab

March 15, 2012

Management and Professional Development Department (MPDD), Lahore

Name	Designation
Mr Hamid Yaqoob Sheikh	Secretary, Livestock & Dairy Development
Dr. Muhammad Shabbir Shahid	Deputy Director, L&DD
Dr Tasneem Akhtar	Director Breed Improvement, L&DDD
Dr Musarrat Abbas Khan	Farm Superintendent/ Research Officer, Livestock Production Research Institute (LPRI), Bahadurnagar
Dr Hans Wagner	Consultant
Mr Ahsan Rana	Consultant
Mr Alex Park	Consultant
Mr Peter Reed	Consultant
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Mr Niaz Akbar	Deputy Program Director, PRMP
Mr Ali Jalal	Assistant Director, PRMP
Ch Hamid Malhi	Director Breeder Association, L&DDD
Dr Muhammad Ashraf Iqbal	Director, Livestock Farms, L&DDD
Dr Ishfaq Ahmad	Research Officer, LPRI Bahadurnagar
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Dr Muhammad Sajjad	Professor Genetics, University of Agriculture Faisalabad
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Mr Muhamamd Nawaz Saeed	Chief Research Officer, BRI Pattoki
Mr Fayyaz Mahmood	Director, LPRI Okara
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Dr Masroor Ellahi Babar	Director (Institute of Bio Technology), UVAS Lahore
Dr Khalid Mehmood Khan	Director, BLPRI L&DDD
Mr Abdul Ghaffar	Principal Scientific Officer, National Agricultural Research Centre, Islamabad
Dr Ghulam Habib	Livestock Coordinator, L&DDD
Dr Rizwan Yousaf	Assistant Professor Reproduction, UVAS Lahore
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Dr. Muhammad Irfan Zahid	Director General (Extension), L&DDD

Workshop
Importance of Breed Improvement for Dairy and Meat Sector Competitiveness
-The Way Forward

Name	Designation
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Mr Safdar Saleem Sial	President Breeders Association, L&DD
Dr Javed Iqbal	Director, RCCSC
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Dr M. Ashraf Iqbal	Director (Livestock Farms), L&DDD
Dr. Mansoor Ahmed	Director, L&DDD Multan
Dr. Muhammad Nazir	Managing Director, Sires Gori Farms (Semen Producer), Sahiwal
Dr. Asad	Deputy Manager
Dr. Mumtaz Khan	Farmer
Dr. Fayyaz Mahmood	Director Livestock Production Research Institute (LPRI), Okara
Mr. Asad Maken	Consultant, DFID PEOP
Dr. Muhammad Rasheed	L&DD Coordinator Focal Person

Appendix D: Medium Term Development of Animals under Recording

Table 2: Medium term development of animals under recording

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Cattle	15,000	20,000	27,500	37,500	50,000	50,000
Buffalo	15,000	20,000	27,500	37,500	50,000	50,000
Total cows	30,000	40,000	55,000	75,000	100,000	100,000
Total stock including young animals	45,000	64,000	111,000	1,75,000	200,000	200,000
Ear tags required	45,000	24,000	32,000	44 000	60,000	80,000
Farms involved	3,000	4,000	5,500	7 500	10,000	10,000
Recorders required	150	200	275	375	500	500

Appendix E: Estimated Cost of Field Recording

Table 3: Estimated cost of field recording (in US\$)

	Unit Cost	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Ear tags	1	40,000	21,000	28,000	38,500	52,500	70,000
Sample bottles	0.35	28,000			28,000		
Dipper/sampler	50	10,000		10,000		5,000	
Weighing scales	50	10,000		10,000		5,000	
Buckets	20	4,000		4,000	2,000	2,000	
Miscellaneous	20	3,000	1,000	1,500	2,000	2,500	2,500
Transport boxes	20	20,000		20,000			
Weighing scales load beams	5,000	20,000		20,000		20,000	
Total		135,000	22,000	93,500	70,500	87,000	72,500

Appendix F: Estimated Cost of Milk Analysis Laboratory

Table 4: Estimated cost of milk analysis laboratory (in US\$)

Milk laboratory	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Lactoscans	12,500		12,500		12,500	
Milk stabilizer	2,000	3,000	4,000	4,500	6,000	6,000
Computer	2,500		2,500		2,500	
Miscellaneous	1,000	1,000	1,000	1,000	1,000	1,000
Total	18,000	4,000	20,000	5,500	22,000	7,000

Appendix G: Estimated Cost of Central Data Management Unit

Table 5: Estimated cost of a Central Data Management Unit (in US\$)

CDU/LGIC	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Computer	50,000			20,000		20,000
Software programs	20,000			7,500		
Office furniture	50,000					
Miscellaneous	10,000	10,000	10,000	10,000	10,000	10,000
Vehicles	70,000			30,000		
Total	200,000	10,000	10,000	67,500	10,000	30,000

Appendix H: Estimated Running Costs of Genetic Improvement Scheme

Estimated running costs of the genetic improvement scheme based on the assumption that the cost of recording 1 cow is US\$15 per year and about US\$700,000 is needed in consultancy services to purchase/develop genetic evaluation programmes and to train local staff.

Table 6: Estimated costs of genetic improvement scheme (in US\$)

Personnel	Unit	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Recording cost	US\$15	450,000	600,000	825,000	1,125,000	1,500,000	1,500,000
Q. Geneticist	1	36,000	36,000	36,000	36,000	36,000	36,000
Genetics buff	1	24,000	24,000	24,000	24,000	24,000	24,000
Genetics cattle	1	24,000	24,000	24,000	24,000	24,000	24,000
Data management	1	24,000	24,000	24,000	24,000	24,000	24,000
Computer manager	2	24,000	24,000	24,000	24,000	24,000	24,000
Data typist	4	16,000	16,000	16,000	16,000	16,000	16,000
Secretary	2	8,000	8,000	8,000	8,000	8,000	8,000
Driver	2	5,000	5,000	5,000	5,000	5,000	5,000
Initial start up		400,000					
Consultant			100,000	80,000	40,000	40,000	40,000
Total		1,011,000	861,000	1,066,000	1,326,000	1,701,000	1,701,000

Appendix I: Conclusions of the Situation Analysis

Conclusions

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. But as stated below because of the unknown genetic quality of the bulls no improvement is achieved.

Semen is produced by four public and eleven private semen 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 as 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.³

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.

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.

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.

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

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

- Cattle: sustainable development and conservation of local dairy breeds; how to deal with cross-breeding and the importing of exotic breed semen; and sustainable development and conservation of local meat and draught breeds.
- Buffalo: sustainable development and conservation of local buffalo breeds; and the role of buffalo for beef production.
- Developing a synthetic breed (cross-breeding of local breeds with exotic imports).

AI Services

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.

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.

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