PAS Agriculture Webinar Episode #3
Genetic Improvement of Dairy Cattle-American and Pakistani Experiences /Policy Brief

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Pakistan is among the top five milk producing countries of the world. Yet, we import significant amounts of powder milk and dairy products. The milk production is an industry in the developed world which is dominated by cows (cattle). In Pakistan, we have a nearly equal population of cows and buffaloes (bovine), raised in a range of systems (household animals, pastoral herds, small peri-urban farms, modern dairying). The milk yield per animal is a genetic characteristic expressed within the animal husbandry environment. With best possible practices, the animals in Pakistan produce only 20% of what dairy cattle produces in the USA. The milk yields in America and the Subcontinent were similar a 100 years ago. Today, America is producing five times more milk from 9 million cows (surplus culled) than in ours 80 million cattle and bovine. The deteriorating genetic potential of our indigenous dairy animals is a serious food security concern. The ever increasing number of bovines also poses a serious threat to land, water resources and climate of the country.

Historically, the breeding practices were the works of amateurs. The herders knew the value of mating bulls and selection for generations. As a result, we have a wealth of genetic resource of milk breeds like Sahiwal, Red Sindhi, Cholistani and Thari cows and Nili-Ravi and Kundhi buffaloes. The Colony settlements in Punjab had special land grants created for maintaining the quality bulls. The land grants for bulls were discontinued with the introduction of artificial insemination (AI). That was for simple economic reasons and potential for a better genetic coverage. Unfortunately, the system has failed to deliver the desired genetic improvement. Instead livestock biodiversity is endangered. In contrast, intensely selected bulls along with AI and ET technology have tremendously improved the genetic potential of dairy animals in USA (Fig. 1).

This episode was organized to understand the causes of declining genetics of our dairy animals and proposing solutions by borrowing American experience. More than 100 participants were logged in from several countries. Dr. Sajjad Khan, Vice Chancellor Cholistan University Veterinary and Animal Sciences gave a detailed overview of the dairy sector of Pakistan. In his view, genetic decline or lack of improvement is an outcome of lack of commitment of our institutions for genetic selection. As a result, low genetic potential semen is being spread in AI. The progeny tested bulls are not being maintained as a source of semen. There is a dearth of records and selection of animals is not being practiced as a future resource. He emphasized that suitable human resources must be immediately produced so that relevant institutions can do mass scale performance recording and genetic selection as anticipated in the Punjab Livestock Breeding Act 2014. Dr. Holly Niebergs, Professor Washington State University, Pullman presented a detailed account of the dairy industry in USA. She made a strong case for genetic improvements using AI where quality of the semen and the skill of technicians made the difference. That was combined with better nutrition, reducing calf to calf time to merely 14 months. Thereby a large

number of generations and breeding populations were available for selection. The selection was further improved with the use of genomic markers. The genetic gains have jumped four folds with the use of genomic selection and use of sexed semen during past 10 years. This has led to the reduction of animals required to meet the milk needs of the country. According to empirically tested data, the milk yield improvements in USA are 56% attributable to the genetics alone and 44% to all other factors i.e. health and husbandry etc.
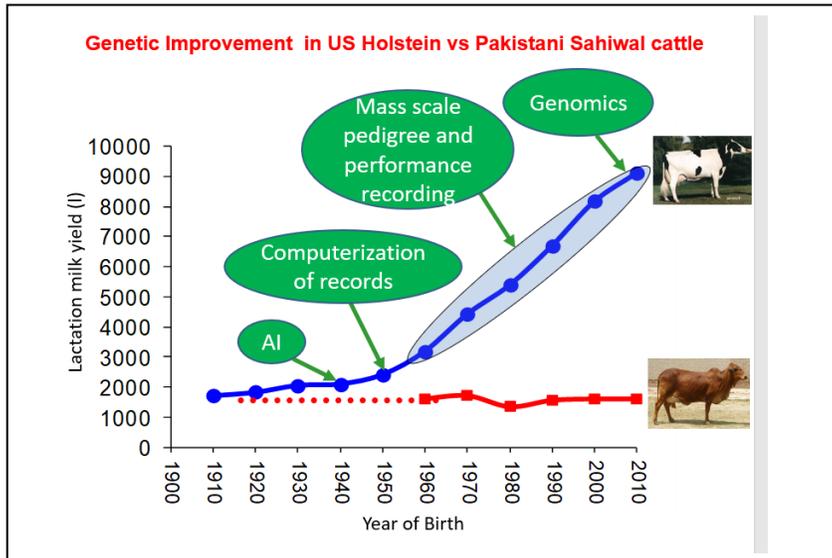

Figure 1: Trends in per lactation milk yield in US Holsteins and Pakistani Sahiwal cattle breed during the past 100 years. Major interventions responsible for many folds increase in milk yields of US Holstein breed are indicated.

Dr. Zafar Qureshi, Dean Faculty of Veterinary Sciences, University of Agriculture Faisalabad sated that the reproductive biotechnologies (sexed semen and In vitro fertilization) can be helpful to make genetic progress tangible after genetic selection is practiced at a national level. Dr. Shahid Mansoor Director NIBGE informed the house that we have sequenced the whole genomes of some of the indigenous breeds of cattle and buffalo. That can be a very useful resource to help advance the selection process. He also shared his work experience with the Military Farms where progeny tested bulls are being maintained. NIBGE is a member of 1000 Bulls Genome Initiative, an international consortium. Dr. Moaeen-ud-Din explained the working of the National Animal Genomics Center at the PMAS Arid Agriculture University, Rawalpindi. He also cautioned that current graduates are not trained for the performance recording required for animal breeding.

Dr. Tasneem, former Director Breed Improvement mentioned limitations of the workforce in the government departments and reiterated that the L&DD Department must focus on Genetic improvement and leave the Veterinary and AI services to the private sector/entrepreneurs.

Dr. Afzal, EX Chairman PARC was of the view that we should focus on medium to large herds and that the private sector should also come forward to implement performance recording and genetic selection of indigenous cattle and buffaloes.

Syed Yawar Ali, Chairman, Nestle Pakistan, has been asking for a debate among the stakeholders to undertake genetic improvement of milk animals. He appreciated the US model presented by Dr. Neibergs.

The Provincial Minister for Livestock and Dairy Development Sardar Hasnain Dreshak co-chaired the session. He appreciated the participation of the guest speaker from USA and the debate by our local speakers and participants. The Minister assured his full support for breed improvement and promised the availability of required resources. He also concurred the need for a revamp of human resource allocation in the line departments.

The ensuing discussion revealed that we have legal framework and infrastructure available for genetic improvement of dairy animals. But our work force distribution is over represented with health-related services. Quality semen is not available due to a lack of record keeping and progeny testing. The AI service in public sector is ineffective because of an inability to reach out the clients. The private sector entrepreneurship is still in the making. Nestle Pakistan has worked with the small to medium sized herd owners to facilitate better services. In response to a question, Dr. Neibergs suggested that Pakistan should include indigenous genetic resource in the improvement programs due to the adaptation advantage. The imported cattle can help bringing in the traits where the indigenous cattle don't excel. The imported herds have a business values that cannot be denied. There was also a discussion of discovering high genetic potential animals and to appreciate the work of amateurs who have maintained high potential bulls and carried out generations of selection. They have exceptional collections. Milking competitions have shown such animals with very high potential. A difficulty with buffaloes to detect silent estruses was pointed out.

The audio/video recording of the event is available at the webpage of PAS www.paspk.org; www.uaar.edu.pk; www.cuvas.edu.pk and at a YouTube link: https://youtu.be/hnMmaDdLmxY

As a summary of the session, following observations and strategic policy recommendations have emerged:

1. Milk production is a product of genetics, better husbandry and nutrition. The milk yields in Pakistan are miserably low compared to the world standards. As a result, we are maintaining large population of low yielding animals. These animals should be progressively replaced with high yielding indigenous or indigenous cross animals through genetic improvement;

2. The genetic improvement of milk yields in USA offers a model that can be replicated in Pakistan provided we have a strict scheme of raising progeny tested bulls and an entrepreneurial service model for AI;

3. The USA success story is heavily built on the application of science in the selection process and regular identification of animals that allows data collection, maintenance and availability for analysis;

4. The Public-Private partnership is required to connect the progeny testing and service delivery with the end user. That could also mean a revamp of human resource training and employment structure by the provincial governments;

5. Realizing the limitations of the small farmers and herders, innovative model of service providers is to be enacted. That can only happen through a major investment strategy where public expenditure could incentivize private investment (credit/State Bank) and entrepreneurship;

6. The access to data should be made a public good through a nationwide federal outfit. The data applications could be developed as business propositions (Apps);
7. A legislative debate should take place to enact laws for transforming animal breeding practices and dairy industry. A system of legislative reporting for debate should be created through a biannual exercise;
8. The prioritized actions are recommended asunder:
    a. A nationwide animal's competition and identification program by district governments and institutions/universities to be made mandatory. Government must ensure sustainability of such programs;
    b. Connecting molecular genetic science with the selection programs by mapping the genetics of selected bulls. Universities and other research institutions must prioritize resource allocation for the collaborative efforts;
    c. Development of semen supply chain and service delivery system customized for all categories of animal ownerships. Institutions such as Buffalo Research Institute should spearhead research for popularizing AI in buffaloes at farmer level;
    d. Revamping of service structure in L&DD Departments and creating service structure to allow production/breeding/genomics/bioinformatic professional to help Government chalk out and execute performance recording and genetic selection programs;
    e. Reanalysis at Government institutions as to what services need to be provided by the Government and what are to be left for private sector; and
    f. A crash program for the training of AI technicians, capacity building of farmers, breed association persons and other stakeholders.