Sindh agricultural growth project – Livestock

Project completion report

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Abbreviations and acronyms

AH	animal health management
AI	artificial insemination
AIT	artificial insemination technician
CGIAR	Consultative Group for International Agricultural Research
CVDL	Central Veterinary Diagnostic Laboratory
DD	deputy director
DFM	district farm manager
DMS	district management staff
DoL	Department of Livestock
DoL&F	Department of Livestock and Fisheries
DPD (Admin)	deputy project director (administration)
DPD (Tech)	deputy project director (Technical)
DPIU	district project implementation unit
DVC	dairy value chain
FBR	Federal Board of Revenue
FEAST	Feed Assessment Tool
FF	feeds and feeding
FMD	foot-and-mouth disease
GDP	gross domestic product
ILRI	International Livestock Research Institute
LA	livestock assistant
LLS	lady livestock supervisor
LPO	livestock production officer
MPG	milk production groups
MT	master trainers
PC	project coordinator
PD	project director
PMU	project management unit
PS	project staff
R&B	reproduction and breeding
SAGP	Sindh Agriculture Growth Project
SAGP-L	Sindh Agriculture Growth Project – Livestock
SPU	semen processing unit
SRB	Sindh Revenue Board
VO	veterinary officer
WB	World Bank
WT	withholding Tax

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We are indebted to Ali Akbar Soomro and Abdul Cader Junejo, respectively former and current director generals of the Department of Livestock and Fisheries of the Government of Sindh, for the support provided during planning and holding of the workshops. We are grateful to Ali Akbar Soomro, Jameel Ahmed Sheikh and Ahtasham -ul-haq, Project Directors, and to Javed Ahmed Memon, deputy project director of SAGP-L, for the support provided in successfully executing ILRI's capacity building activities. We acknowledge the support provided by the World Bank for funding this project. We also thank ILRI management, scientists who conducted trainings in Pakistan and ILRI's capacity building unit for compiling the training facilitation manuals.

Executive summary

Pakistan's Sindh province has a high poverty rate. Between 30-35 %% of the population in the rural areas lives below the poverty line. Agricultural production in the province is dependent on sharecropping, the rate of which has persistently been twice the rest of the nation. The Sindh Agriculture Growth Project (SAGP), funded by the World Bank, aimed to improve the productivity of small and medium producers through targeted interventions in selected commodity value chains in the ten districts in Sindh province.

The International Livestock Research Institute (ILRI) was working in the dairy value chain component of the project between September 2017 and June 2020. The project had two components (I) investing in knowledge and technology for producers in the crops and livestock sub-sectors and (II) strengthening public sector institutions to enhance the enabling environment for sustained sectorial growth. An inception workshop was held in October 2017 to establish ILRI's contributions to these two project elements.

Through the component, 'capacity building and institutional development', ILRI developed train-the-trainer instruction modules on feeds and feeding, animal health management, and reproduction and breeding in English and Sindhi. Training programs were delivered in multiple sessions to selected representatives from district, field extension staff (para-vets, stock assistants and inspectors) and farmer milk producing groups. Nearly 5,000 trainers participated in the training covering each of the modules. ILRI hosted international visits to Kenya and national visits to Punjab province. Additional smaller workshops on silage making, the ILRI Feed Assessment Tool (FEAST), rhodes grass, genetic improvement in ruminants, and artificial insemination in goats were organised. Finally, a trial on free access to animal inking water and feed roughage was demonstrated on two farms.

The second component 'investment for agricultural growth' had four sub-components[1] out of which ILRI focused on component three. ILRI leveraged previous relationships with 153 milk producing groups (MPG) comprising nearly 7,200 members in all the provincial districts. These groups were then targeted for capacity building activities, technical assistance, entrepreneurship development, and seed distribution.

The impact of ILRI's efforts resulted in measurable improvements in milk production from improved feed and fodder and access to inking water, animal health from vaccinations, deworming, sanitation, inspection/awareness, and record keeping and breeding from reproductive calendar distribution, bull selection, artificial insemination, and herd culling.

[1] Component 1: Horticulture value chains; Component 2: Rice post-harvest loss management, Component 3: Dairy value chain; Component 4: Demand driven innovation fund.

Future efforts can continue to build on the growing number of MPGs by improving milk hygiene, establishing sustainable grazing lands, expansion of collection centres/production facilities, broadening the dairy product offerings and creating an export market.

Introduction

Agriculture (crops and livestock) contributes 11.4% of Pakistan's GDP while livestock contributes 58.3% of total agriculture contribution to GDP (Government of Pakistan, 2016-17). About 8.5% of total exports are derived from livestock, livestock products and by-products. Livestock remains the source of funds and means of saving for the rural population. According to Livestock Census 2006, Sindh has the second highest animal population in Pakistan (32.144 million heads).

Sindh is the major agricultural province in Pakistan following Punjab. The productivity of most of the crops of Sindh is higher as compared to Punjab. 23.8 % of Pakistan's population lives in the province. Sindh covers 18 % of Pakistan's land area and 16 % total cropped area. It contributes about 23 % to national agriculture value-added primarily through wheat, rice, cotton, sugarcane, and milk. Sindh has a larger %age of small and medium farmers as compared to Punjab. About 30-35 % of Sindh's population lives below poverty line, and majority of the poor are living in rural dwellings. Sindh's poverty is often attributed to inequality in land distribution which has increased over time. Production largely depends on sharecropping (42 % of farms in Sindh), the extent of which has remained nearly twice as much as other provinces for the last 50 years. Majority of the small- and medium-scale farmers are poor and keep their livestock for aught and milk purposes. Farmers do not afford machinery due to small holdings. In Sindh, the role of livestock in rural economy may be realized from the fact that 30-35 million rural population is engaged in livestock raising and have household holdings of 2-3 cattle/buffalo and 5-6 sheep/goat per family deriving 30-40 % of their income from it. The Government of Sindh through the Government of Pakistan has received an International Development Association credit to meet part of the costs for the SAGP. The aim is to uplift the overall productivity of agriculture sector through various targeted interventions in commodity specific value chains and inculcate the best management practices. The project component on livestock was implemented by the Department of Livestock and Fisheries, Government of Sindh.

The development objective of SAGP for Pakistan is to improve the productivity and market access of small- and medium-scale producers in important commodity value chains. The project had three components namely, capacity building and institutional development, Investment for agricultural growth, and project management, monitoring and evaluation. SAGP aims to improve the productivity and competitiveness of small and medium producers in selected commodity value chains. This will be achieved by investing in knowledge and technology for producers, sub-sectors of crops and livestock and strengthening public sector institutions to create enabling environment for sustained sectorial growth. The project will focus on five key value chains namely, chilies, onions, dates, rice post-harvest losses management, and dairy. These value chains are small/subsistence farmers centred, with significant involvement of women in production and processing.

1. Capacity building and institutional development: support capacities of producers through technology development, technology dissemination, training, and exposure. It includes the following three sub-components:
    i. Capacity building of producers
    ii. Modernization of extension services and agricultural research
    iii. Strategic planning for the agricultural sector.
2. Investment for agricultural growth: support specific investments in the horticulture and dairy value chains and a targeted investment to reduce post-harvest loss among small-holder rice growers. It will also support demand driven innovation fund to support farmers and producers with technology innovations in the selected value chains. It includes following four sub-components:
    i. Horticulture value chains
    ii. Rice post-harvest loss management
    iii. Dairy value chain
    iv. Demand driven innovation fund

The project component on livestock has the following specific objectives:

- **Component A - Capacity building and institutional development**
  This component financed activities around technology development, technology dissemination, capacity building and strategic planning for Sindh's Livestock sector.
- **Component B: Investment for livestock growth**
  Component B financed formation of MPGs in all targeted districts. It targeted small- and medium-scale milk-producing households. At least 80 % women are involved in production management. Therefore, the project provided services exclusively targeting women (e.g., extension messages, female extension agents, etc.).
- **Component C: Project management, monitoring and evaluation**
  This component focused on the overall monitoring and evaluation of the activities under the livestock component. This component provided support to follow the right track to achieve the set targets under SAGP-L.

Under component B, the project objective was to form MPGs and provide chiller room, chiller and milk tester for each MPG established. The project target was to establish 153 MPGs in the project districts. Plan International Pakistan was commissioned to undertake this activity. Plan initiated its activities by hiring an independent consultancy firm to undertake a baseline survey to identify potential milk pockets in the 10 project districts. The survey covered 671 villages and collected data from 66,673 households. As an initial step, 185 potential locations were identified based on milk pockets and market access. Social mobilization process was initiated in the top 153 locations for the formation of MPGs. Thereafter a series of dialogues on advantages of group formation and benefits of working as a group were held with the farming community. Farmers with 2-5 milking cows (cattle and

buffaloes) were invited to apply for membership on a prescribed form. At the first formal meeting held with the members of the MPG, the executive committee comprising of presidents, general secretary and finance secretary were elected.

Objectives of ILRI's capacity building component

- Design capacity building and training interventions for various stakeholders at provincial, district and field levels and producer groups in each of the selected districts.
- Organize in-country and overseas exposure/training visits.
- Conduct seminar/workshop/farmers days/ hands on training and demonstration for producers.

Scope and tasks:

- Develop training manuals and extension materials catering towards the capacity building needs of all the stakeholders in the dairy value chain.
- Capacity building of all stakeholders involved in the dairy value chain.
- Organize in-country and overseas educational/field visits.

The expected deliverables were to develop a training curriculum, manual, modules, and tools. ILRI also developed dynamic training curriculum focused on the selected value chain nodes. These nodes include information and guiding materials on cutting edge knowledge on livestock management and husbandry, information and instructional materials on dairy business, hands on practice and demonstration materials. The course tools include manuals, hand-outs, and practical exercises. ILRI also adopted participatory learning approaches, exposure visits, on the job training, continuous mentoring and follow up.

The following were identified as the key capacity building needs:

- Communication skills
- Feeds and feeding
- Animal health management
- Breeding and genetic improvements
- Modern dairy farming practices

Initiation of ILRI activities

The project had a duration of 20.5 months (up to 30 June 2019), according to the agreement signed with SAGP-L on 15 September 2017. The request letter to initiate activities was issued by the SAGP-L Project Director on 13 October 2017. Since then, the following activities were operationalized:

1. Professor Mohamed Ibrahim (Country Representative for ILRI in Pakistan) who has been backstopping SAGP-L took became Team Leader of SAGP-L ILRI component.
2. ILRI appointed Shahid Ali Khan under a consultancy agreement as a Project Coordinator.

3. Inception workshop and the first capacity building training for provincial staff of Pakistan's Department of Livestock took place respectively on 24 and 25 October 2017.
4. In January 2018, inception workshop report was accepted, and the following additional staff members were recruited:

Table 1 Staff recruited under SAGP-L project

Employee Name	Designation	Category
Deepesh Kumar	Research associate	Scientist
Ubaid Qureshi	Research associate	Scientist
Barket Ali Kalwar	Research associate	Scientist
Mariam Yaqoob	Research associate	Scientist
Murk Pirzada	Research associate	Scientist
Rifat Un Nisa	Research associate	Scientist
Shahzad Iqbal	Research associate	Scientist
Jamila Jatoi	Research associate	Scientist
Kamran Riaz	Accounts manager	Support
Mohan Bekhchandani	Admin and finance assistant	Support

Inception workshop

ILRI organised SAGP-L project inception workshop on 24 October 2017 at Indus Hotel, Hyderabad. The theme of the workshop was 'Capacity building of dairy value chain stakeholders in Sindh' with an aim of developing a cohesive understanding of the scope of the livestock capacity development component of the project. ILRI used the opportunity to highlight its project implementation approach, the capacity development activities it will carry out and showcase some of the tools and innovations to be used.

The following were additional objectives of the workshop:

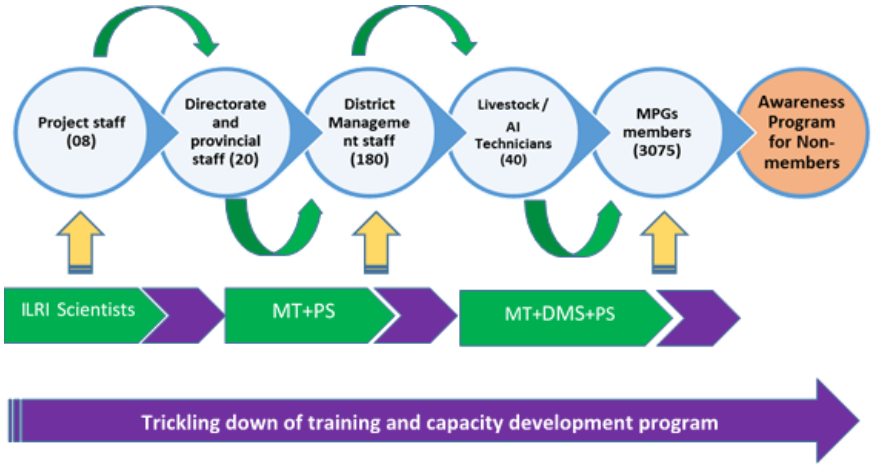
- Develop a common understanding of the expectations from various stakeholders and actors in the dairy value chain.
- Overview of approaches, procedures and implementation plan of the capacity building component based on current trends and indigenous practices.

The workshop was officiated by Ali Akbar Soomro, Director general, Sindh. Seventy participants representing various stakeholders, mainly from livestock and agriculture sectors, livestock department of the Ministry of Livestock and Fisheries officials, NGOs, Universities, donor agencies, monitoring and evaluation Consultants, medicines and feed companies and print and electronic media. Professor Ibrahim welcomed the participants and briefed about ILRI activities in Pakistan.

Javed Ahmed Memon, deputy project director, SAGP-L briefly updated about progress made by the project and welcomed ILRI for being a partner of the project for the capacity building of all stakeholders in the target districts of Sindh. Mr Saleh Mangi, Team Leader Plan International, congratulated ILRI for starting its activities and

expressed his hope that ILRI will accomplish the capacity-building component in a timely manner. Mr Edwin Kangethe and Mr Zeeshan Mustafa delivered presentations on ILRI's activities. Professor Ibrahim shared ILRI's work plan of conducting training workshops at various levels. ILRI's capacity building activities is summarised in the pictorial presentation below.

Figure 1 ILRI's capacity building model



ILRI's main partners to implement the project include, livestock department staff, district livestock department staff, field extension staff and MPGs. It was agreed that ILRI will undertake the following capacity building activities:

1. Develop training manuals and extension materials that cater the capacity building needs of stakeholders involved in the dairy value chain (district technical staff, district field staff and MPG members).
2. Build the capacity of all stakeholders involved in the dairy value chain on the following areas:
    - Animal health management
    - Feeds and feeding strategies
    - Animal reproduction & breeding
    - Awareness programs on selected MPGs on modern dairy production practices
3. Organizing in-country and overseas educational/field visits

In his concluding speech, Ali Akbar Soomro welcomed ILRI for being a key shareholder for undertaking capacity building of the departmental staff as well as other stakeholders in the target districts under SAGP-L. The event was concluded with an interview with DAWN media with Professor Ibrahim and Soomro regarding ILRI's role in ongoing current project of SAGP-L in Sindh. The team leader also highlighted ILRI's activities worldwide. The inception report was approved by the SAGP-L in January 2018.

The inception report can be accessed using this link
https://cgiar.sharepoint.com/:b:/s/SAGP/ERQEBKLOJaFHsSsbCVYbnwQBNDqIghrYBN7ARyEaSS9D-Q?e=NTHAly..

Compilation of training materials

ILRI's training materials (modules and tools) along with the knowledge/experience in executing other livestock projects in Pakistan helped to design robust capacity building and training interventions for various stakeholders including the Department of Livestock's provincial, district and field level staff and dairy farmer MPGs.

Training materials focussing on cattle and buffaloes were prepared by the ILRI team and finalized after several rounds of 'consultative workshops' with Sindh Livestock Department, SAGP-L and Plan International Pakistan. Using these training materials (English/Sindhi), over the past 3 years ILRI conducted more than 12000 training programs on various aspects of dairy production to provincial staff, district staff (veterinary officers, para-veterinarians, livestock assistants), and to 153 MPG members and non-members in the 11 project districts.

Before starting capacity building activities for MPGs, a consultative workshop was organized at Crown Hotel, Hyderabad on 30 March 2018. It was attended by 29 participants. The workshop introduced training materials with stakeholders. Professor Ibrahim welcomed participants, introduced the objectives of the workshop, and delivered a detailed presentation on training materials on feeds and feeding and animal Health management. The materials have been developed by ILRI for the MPG members in the local language (Sindhi).

Figure 3 Training materials developed by the SAGP-L project

Figure 2 Training materials developed by the SAGP-L project

Professor Ibrahim explained also introduced methodology and work plan of the training. All training materials were provided to each participant and master trainer.

In his concluding remarks Ali Akbar Soomro, Director general Livestock/Project Director SAGP-L, said that following his visits all over Sindh, he observed that farmers are failing to make profits out of the livestock business. And hoped that the ILRI team will improve this situation by training farmers on profitable approaches to livestock business.

ILRI organized a consultation workshop on 'animal reproduction, breeding and genetic improvement', for all stakeholders of SAGP-L on preparation of training materials for MPG members. Jamil Ahmad Shaikh, Director general, research, and extension, Sindh, and Project Director SAGP-L, Ahtasham-ul-haq, Director, animal husbandry Sindh Hyderabad, Ghulam Mustafa Panhwar, executive director, animal breeding Sindh Hyderabad, and Zakir Hussain Subhopoto, director, animal breeding

Sindh Hyderabad participated in the workshop. 44 participants including all district focal persons from the departments of animal husbandry and animal breeding of Department of Livestock and Fisheries (DoL&F), Project Management Unit (PMU) and District Project Implementation Unit (DPIUs) technical staff and ILRI staff participated in the workshop.

A second consultative workshop with all SAGP-L stakeholders was conducted at Crown Hotel, Hyderabad on 14 October 2019. It was attended by Ahtasham Ul Haq, Director of animal husbandry, Sindh, Muzaffar Vighio, Director of animal breeding, Sindh, Javed Memon and Elahi Bux Jogi, deputy project director, SAGP-L. Fifty-four participants including all district focal persons from animal husbandry and animal breeding units of DoL&F, technical staff of all DPIUs and ILRI staff participated.

Professor Ibrahim introduced the training materials for MPG members and gave one copy of each booklet to all participants. Ibrahim talked about animal reproduction, breeding and genetic improvement. He also explained the cow calendar and its benefits.

Figure 4 Cow calendar

While concluding the session, Ibrahim said that these training programs, to be conducted with stakeholders, would make visible change in adaptation of good breeding practices which will lead towards good genetic potential among Sindh's indigenous breeds. Vighio assured full support on behalf of focal persons and service providers to the training team in all the districts.

Junejo appreciated ILRI efforts, particularly Ibrahim, for their dedication in uplifting the livestock sector in Sindh.

The training materials used for capacity building of master trainers, DoL provincial staff and DoL district level staff for the 3 modules are attached to this report.

1. Animal health management
2. Feeds and feeding strategies
3. Animal reproduction, genetics, and breeding

For MPG members training, a series of 3 ft x 4 ft flexes in Sindhi language were prepared for the above subject matters (Annex: Animal Health MPG Training (Sindhi), Annex: Feeds and feeding MPG Training (Sindhi) and Annex: Reproduction and breeding (Sindhi)).

The final output of these trainings is the publication of three facilitation training guides namely, feeds and feeding, animal health management and reproduction and breeding.

ILRI's capacity building activities under SAGP-L

ILRI's capacity building activities fall under Component A[2]. The institutional development component was partly addressed by training of all livestock department staff at provincial and district level (both office and field level staff) on technology dissemination. SAGP-L project management unit was responsible for infrastructure development.

Training of master trainers and directorate/provincial staff of department of livestock and fisheries

In the first phase of the capacity building plan, a training for trainers (ToT) on 'Communication strategies and innovative management tools for dairy value chain stakeholders in Sindh' was organized on 25 October 2017 at Indus Hotel, Hyderabad. 24 participants including provincial staff of the livestock department, staff of SAGP-L and Plan International staff participated. Ibrahim informed participants that the trainings will start from project district level and that training programs will be conducted on animal health management, feed and feeding, reproductive disorders, breed, and genetic improvement to help district staff provide good quality services to farmers. Kangethe and Philip delivered presentations on communication techniques and tools for development communication. The trainers also introduced and demonstrated the electronic mastitis detection kit and Portable Agri Near Infrared Reflectance analyser procured by ILRI Pakistan office under ILRI-agricultural innovation project (AIP). Shaikh appreciated ILRI's support for capacity building efforts which are useful to deliver better services to farmers and in return increase productivity of animals.

Professor Okeyo Mwai, Senior Scientist at ILRI conducted a training workshop on 'Animal reproduction, breeding and genetic improvement' at the Crown Hotel, Hyderabad. 24 participants consisting of ILRI, and SAGP-L technical staff attended the workshop. Mwai shared covered topics on animal reproduction, breeding and genetic improvement. He further discussed in detail the common malpractices

- [2] Component A - Capacity Building and Institutional Development: This component will finance activities around technology development, technology dissemination, capacity building and strategic planning for Sindh's Livestock sector.

around reproductive cycle of the cow, breeding and genetic gain for future generations.

Capacity building of district livestock department staff

Veterinary officers and farm managers of all target districts were trained on communication skills, extension techniques, dairy value chain concepts, animal nutrition and feeding, animal health management, breeding and genetic improvements, dairy farming and best farming practices, procurement, processing, and marketing strategies. These trainings were conducted by master trainers recruited by ILRI.

Training of district level staff on 'dairy production technologies' for project implementation staff (district farm managers and lady livestock supervisors), District Officials (Deputy Director Livestock and Assistant Director Livestock) and veterinary officers of all target districts were conducted at Crown Hotel Hyderabad in February 2018. The district staff were trained on two modules (i) animal health management and (ii) feeds and feeding. The objectives of the trainings were to introduce modern techniques and to share advanced research-based knowledge, to enhance knowledge, skills, and capacity for delivering of quality services to field extension staff and farmers. The feeds and feeding session was conducted by Ibrahim and animal health management by Khan.
List of participants from each of the project districts can be found on Table 2.

Table 2 Trainings conducted for district staff on animal health and feeds and feeding

	Districts	Date of Training	Total Participant
1	Mirpurkhas & Umer Kot	12 February 2018	81
2	Shaheed Benazirabad & Nosheroferoz	13 February 2018	
3	Thatta & Hyderabad	14 February 2018	
4	Tharparkar	16 February 2018	
5	Tharparkat	19 February 2018	136
6	Mirpurkhas & Umer Kot	21 February 2018	
7	Thatta	23 February 2018	
8	Shaheed Benazirabad & Nosheroferoz	26 February 2018	
9	Khairpur & Sukkar	11 October 2018	
10	Larkana & Qamber shahdadkot	16 November 2018	
	Total		**217**

Capacity building training for field extension staff

Field extension staff, livestock department staff (AI technicians, livestock assistants), NGOs and private sectors of all target districts were trained on communication skills, protocols on extension, dairy value chain concepts, concepts of farmer organizations, animal nutrition and feeding, animal health management (disease prevention and control), breeding and breed improvements, dairy farming and best farming practices, procurement, processing, and group marketing strategies. These trainings were offered over 2 days and were conducted by master trainers recruited by SAGP-L. Number of field staff trained in each district is summarised in Table 3.

Table 3 District level combined trainings conducted for district field staff (para-vets, stock assistants & inspectors) on animal health and feeds and feeding

Sr. No.	District	Date	Animal husbandry (stock assistant)	Animal breeding (livestock inspectors)	CVDL technician	Guests (A.D/D.D/V.O/DFM/LLS)	Total
1	Tharparkar	19 Feb 2018	13	1	1	7	22
2	Hyderabad	21 Feb 2018	4	2	0	7	31
3	Mirpurkhas		5	3	0		
4	Umerkot		8	2	0		
5	Thatta	23 Feb 2018	11	2	0	6	21
6	Sujawal		2	0	0		
7	Naushahro Feroze	26 Feb 2018	16	5	1	4	37
8	Shaheed Benazirabad		7	4	0		
9	Khairpur	11 Oct 2018	20	3	0	11	35
10	Sukkur		1	0	0		
11	Larkana	16 Nov 2018	15	0	1	4	25
12	Qamber Shahdadkot		4	1	0		
Grand total			**106**	**23**	**03**	**39**	**171**

Capacity building of farmer milk producer groups

Members of MPGs set up by the project were trained on concepts of feeds and feeding strategies, animal disease prevention and control, breeding and breed improvements, best dairy farming practices (cattle and buffaloes). For each MPG, participants for the trainings were nominated by Plan International in consultation with the executive committee of the MPGs. Trainings were conducted by ILRI, field level extension and PMU staff under the guidance of ILRI scientists. The training included topics on improved dairy practices on feeds and feeding strategies, disease prevention and control, genetic improvement and breeding strategies and clean and hygienic practices in milk production. The commitment made in the agreement signed with SAGP-L was to train 3075 dairy farmers in the 153 MPGs spread across 11 project districts. However, during observation visits to MPGs, the membership in all 153 MPGs is 4142 higher than the initial plan (Table 4).

Table 4 Number of MPGs formed per district and their membership

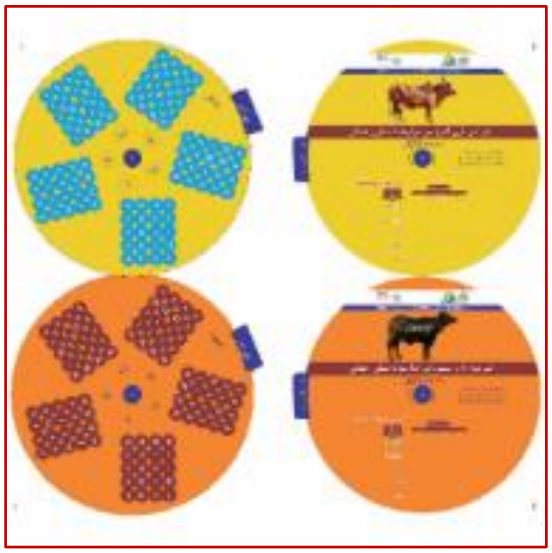
Sr. No	District	DPIU	No. of MPGs formed/district	Total members per district
1	Hyderabad	Thatta	3	169
2	Thatta	Thatta	11	549
3	Sujawal	Thatta	9	395
4	Mirpurkhas	Mirpurkhas	10	404
5	Umerkot	Mirpurkhas	8	355
6	Naushahro Feroze	Shaheed Benazirabad	17	815
7	Shaheed Benazirabad	Shaheed Benazirabad	13	602
8	Tharparkar	Tharparkar	21	1,206
9	Sukkur	Khairpur	8	375
10	Khairpur Mir's	Khairpur	23	844
11	Larkana	Khairpur	30	1503

Total No.	**11**		**153**	**7,217**
EOP Target	**11**		**153**	**3,075**

Training courses on animal health management

Training sessions on animal health management were conducted from February to November 2018 on all 153 MPGs established in the 11 project districts. In total 4828 farmers participated, which included 2760 men and 2068 women dairy farmers. List of MPG trainees is shown on Table 4 below. In addition to dairy farmers, the respective District Livestock Department staff (Deputy Director, focal persons, field level staff) participated in the trainings. Trainings were conducted by master trainers (lady livestock supervisors and ILRI training associates) under the guidance of ILRI staff.

Figure 5 Feeding Charts for cattle & Buffaloes



Training sessions conducted include biosecurity (prevention, control, and treatment of economically important diseases) and the importance of record keeping for which ILRI introduced an animal health recording card. Training materials (3 ft x 4 ft Flexes) were used for training, and a booklet was prepared (in English/Sindhi languages) and distributed to the participants.

Table 5 Number of MPG members and non-members trained on animal health management

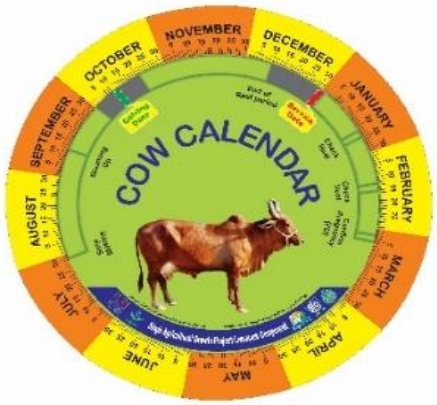
S.#	District	# of MPGs	Total No. of Participants						
			Members		Non-Members		G. Total (M+N.M)		
			M	F	M	F	M	F	Total
1	Hyderabad	3	49	29	14	11	63	40	103
2	Thatta	20	360	199	69	59	429	258	687
3	Tharparkar	21	343	236	41	80	384	316	700
4	Mirpurkhas	10	165	93	15	40	180	133	313
5	Umerkot	8	169	93	10	19	179	112	291
6	Shaheed Benazirabad	13	235	139	20	13	255	152	407
7	N. Feroze	17	220	195	41	27	261	222	483
8	Khairpur	23	288	225	111	57	399	282	681
9	Sukkur	8	84	81	28	22	112	103	215
10	Larkana	20	280	245	67	66	347	311	658
11	Qamber ShahdadKot	10	114	122	37	17	151	139	290
Total		153	2307	1657	453	411	2760	2068	4828

Trainings on feeds and feeding

Trainings on animal feeds and feeding strategies were conducted on all 153 MPGs established in the 11 project districts. In total 4975 farmers participated in the 153 trainings, which included 2792 males and 2183 female dairy farmers. List of MPG trainees is provided on Table 5 below. In addition to dairy farmers, the respective District Livestock Department staff (DD, focal persons, field level staff) participated in the trainings. Trainings were conducted by Master trainers (LLS and training associates) under the supervision/guidance of ILRI staff.

Training sessions conducted included basics of animal nutrition and important nutrients, feed types and their nutritive value, nutrient requirements, and balanced feeding to match production requirements. As a guide for feeding, ILRI introduced a simple feeding chart for cattle and buffaloes (Annex: Feeding chart - Sindhi).

Figure 6 Breeding guide for cattle



Training materials (3 ft x 4 ft Flexes) were used for training and booklets were prepared in English and Sindhi and distributed to participants.

Table 6 Number of MPG members and non-members trained on animal feeds and feeding

S.#	District	# of MPGs	Total No. of Participants						
			Members		Non-Members		G. Total (M+N.M)		
			M	F	M	F	M	F	Total
1	Hyderabad	3	47	33	14	11	61	44	105
2	Thatta	20	349	225	60	100	409	325	734
3	Tharparkar	21	340	246	42	72	382	318	700
4	Mirpurkhas	10	160	75	28	44	188	119	307
5	Umerkot	8	175	102	15	19	190	121	311
6	Shaheed Benazirabad	13	243	142	32	28	275	170	445
7	N. Feroze	17	250	190	45	43	295	233	528
8	Khairpur	23	299	233	113	61	412	294	706
9	Sukkur	8	86	81	33	26	119	107	226
10	Larkana	20	241	238	83	82	324	320	644
11	Qamber ShahdadKot	10	96	120	41	12	137	132	269
Total		153	2286	1685	506	498	2792	2183	4975

Trainings on animal reproduction and breeding

Trainings on animal health management were conducted from February to June 2019 on 149 MPGs (3 MPGs were non-functional and were dropped by the project management unit). In total 4831 farmers participated in 149 trainings, which included 3125 men and 1706 women dairy farmers. MPG trainees are shown on Table 6. In addition to dairy farmers, the respective district livestock department staff (Deputy Directors, focal persons, field level staff) participated in the training programs. Training was conducted by master trainers (LLS and ILRI training associates) under the guidance of ILRI staff.

Training sessions conducted included male and female reproduction organs, breeding methods (natural and AI), criteria for breeding, selection and culling of animals and the importance of breeding record keeping. ILRI introduced the ‘cow calendar’ to help farmers in estimating due dates for breeding and calving. Training materials (3 ft x 4 ft Flexes) were used, and English and Sindhi booklets were prepared and distributed to the participants (Annex: Cow calendar English)

Table 7 Number of MPG members and non-members trained on animal reproduction and breeding

S.#	District	# of MPGs	Total No. of Participants						
			Members		Non-Members		G. Total (M+N.M)		
			M	F	M	F	M	F	Total
1	Hyderabad	3	67	26	12	13	79	39	118
2	Thatta	20	312	198	119	132	431	330	761
3	Tharparkar	18	292	228	76	93	368	321	689
4	Mirpurkhas	10	139	59	80	58	219	117	336
5	Umerkot	8	163	18	45	2	208	20	228
6	Shaheed Benazirabad	12	184	118	46	17	230	135	365
7	N. Feroze	15	277	51	52	26	329	77	406
8	Khairpur	22	472	181	54	48	526	229	755
9	Sukkur	5	82	0	78	0	160	0	160
10	Larkana	18	274	298	102	103	376	401	777
11	Qamber ShahdadKot	9	156	27	43	10	199	37	236
Total		140	2418	1204	707	502	3125	1706	4831

Awareness workshops for members/non-members of some selected MPGs

Farmer-centred knowledge sharing awareness program on capacity building activities was carried out in connection with ILRI's capacity building program for the farmers on improving their routine practice in animal health management, feeds and feeding and animal reproduction, breeding and genetic improvement. ILRI has provided training for MPG members on the topics mentioned above. The workshops were organized as a refresher activity for broader MPG farmers including members and non-members with an objective of building capacity in adopting common practices that yield higher profitability in milk production and increased income. The program targeted the youth. The specific objectives of organizing awareness workshops were:

1. Refresher of the trainings on animal health management, feeds and feeding practices to MPG members.
2. Share the knowledge of trained farmers (members) with the other farmers (non-members).
3. Improve the services, such as timely vaccination and deworming (including recording of services on 'health card') and proper treatment of the animals.
4. Raise awareness on bio-security measures which should be routine practices.
5. Increase vigilance on zoosanitary measures such as handling in case of outbreaks.
6. To ensure the adoption of basic farm practices like free access to water or increase the frequency of water offered to animals, use of salt on daily basis and to offer the required feed and fodder based on daily production of the animal by using 'feeding chart'.
7. To share knowledge on cultivating new grasses and conserving fodder for long periods for regular supply of fodder on reasonable rates to animals.

Figure 7 Awareness program for MPG non-members (men and women groups separately)

From district level, initially 20 model MPGs were selected by the ILRI team based on set criteria (cooperation given by the executive committee, number of farmers, the amount of daily milk collection, receptiveness to innovations, etc.) to conduct awareness program. ILRI aimed to conduct 10 awareness programs on improved dairy technologies and instead was successful in conducting 15 workshops where 1720 farmers participated. Overview of the number of awareness workshop conducted at district level is shown on Table 7.

Table 8 Summary of awareness workshop in selected MPGs

Sr. No.	District	Date	Name of MPG	Total Participants			Total
				Male	Female	Guests	
01	Thatta	18 April 2019	Khamiso Khan Samo	88	24	00	**112**
02	Mirpurkhas	24 April 2019	Jeelani	114	02	00	**116**
03	Hyderabad	25 April 2019	Gul Lashari	57	32	00	**89**
04	Mirpurkhas	24 June 2019	Bhaloo Bhatti	90	64	00	**154**
05	Thatta	26 June 2019	M.Siddique Balouch	81	00	05	**86**
06	Shaheed Benazirabad	24 July 2019	Hoat Je Wahn	69	30	00	**99**
07	Shaheed Benazirabad	25 July 2019	Maro Mehar	104	42	00	**146**
08	Tharparkar	29 August 2019	Sujhag Hala	62	84	10	**156**
09	Tharparkar	17 September 2019	Roshan Rahoon	76	45	04	**125**
10	Naushahro Feroze	08 October 2019	Abra Co-operative	89	22	00	**111**
11	Naushahro Feroze	09 October 2019	Qamar Din Chandio	78	48	00	**126**
12	Larkana	22 January 2020	Sajjan Hakro	72	0	5	77
13	Umerkot	28 January, 2020	Sarwari Co-operative	109	0	2	111
14	Umerkot	30 January, 2020	Habib Halepoto	77	52	7	136
15	Khairpur	13 February, 2020	Sukh Wahan	**84**	**25**	**0**	**109**
	Total			**1250**	**470**	**33**	**1753**

International and national exposure visits

International exposure visit

DoL&F and the Project Implementation Unit organized international exposure visits to the Kenyan Creamery Company (KCC) in Nairobi, Kenya from 24 to 27 September 2018 (excluding travel days) for the Project team based in Hyderabad. The aim was to familiarize the team with the dairy hub approach set up in collaboration with ILRI.

Participants visit to ILRI Headquarters in Nairobi (photo credit: SAGP-L).

Objective of the visit was to further achieve innovation, development, and sustainability of SAGP-L project's dairy value chain efforts.

The program included:

- Visit ILRI Headquarters, laboratories and ILRI livestock research farms.
- Visit small and medium dairy farmers' holdings.
- Visit small, medium, and large milk dairy cooperatives.

Field visit participants gained insights on the history and development of dairy value chain in Kenya. Participants visited from the smallest to state-of-the-art dairy/meat farms to gain insight on how innovation is changing the mind-set as well as practice of small farmers. During the visit participants, visited several dairy cooperatives ranging from a 150 members' entity to a 17,000 plus members cooperative.

Visit to Dairy cooperative in Kenya (photo credit: SAGP-L).

The visit was a success as it helped broaden the horizons of the core management team of the SAGP on how the learning curve from Kenya could be successfully employed in directing the MPGs into sustainability with precision.

Use of appropriate dairy technologies and techniques so that MPGs can gain strong foothold towards self-development as well as sustenance were the main learnings of the visits which were implemented in the 10 intervention districts of Sindh province.

Visit to the shop managed by the cooperative to serve its members (photo credit: SAGP-L).



National field exposure visits

A national field exposure visits of MPG executive committee, milk technicians and AI technicians to Farmer Managed Cooperative (FMC) in Vehari district, Punjab, was organised for learning and familiarization with ongoing activities at FMCs in the district, including product processing and marketing practices. The FMCs in the district were established under the 'Plan milk value chain project' and the 'Women economic empowerment project'. Six visits were undertaken and in total 141 members participated. Table 8 below shows the list of MPGs and visited districts.

Table 9 Summary of number of MPGs and members participated in the national exposure visits

District	No. of MPG	No. of Participants
Thatta	18	36
Hyderabad	3	6
Tharparkar	11	21
Mirpurkhas	9	19
Shaheed Benazirabad	9	18
Naushahro Feroze	11	21
Khairpur Miris	5	10
Umerkot	4	8
Sukkur	1	2
Total	**71**	**141**

Participants visited 4-5 farms and 1-2 private enterprises. The list of FMCs and other enterprises visited are listed below.

- FMC Noor Milk Cooperative 190/WB (Vehari)
- FMC Ghanj Shakkar Milk Cooperative at Moza Haleem Khichi (Melasi)
- FMC Kot Haru Milk Cooperative at Kot Haru (Melasi)
- FMC Gujjar Milk Cooperative at 170/EB (Vehari)
- FMC Ghousia Milk Cooperative at 569/EB (Vehari)

- FMC Gulshan Milk Cooperative at 509/EB (Burewalla)
- FMC Sardar Milk Cooperative at 453/EB (Burewalla)
- Zain Dairy Farm Near Gagoo Mandi (Burewalla)
- HR silage Factory (Near Melasi)
- Mashallah Dairy Farm Ali Wah (Near Melasi)

The protocol followed during the visits and exposures to different activities are elaborated below:

Formation process and key learnings

- Introduce the role of FMC executive body and FMC members.
- Learn about record keeping processes.
- Increase membership base.
- Active participation for quality services.
- Discussions with FMC's executives on the status of the cooperatives, challenges,
- Sharing of knowledge with visitors about the capacity building trainings

Introduction by Punjab cooperative department: Coordination role with FMCs

- Created awareness about the registration process of FMCs by Punjab cooperative department.
- Assistant registrar of Punjab Cooperative Department shared the key learnings with MPG executives for sustainability of MPGs.

Visit of chiller room and awareness about the marketing and saving system

- Plan International Pakistan under Punjab Milk Village Cooperative Project (PMVCP) has provided a chiller tank of 500-Liters which was installed in a rented shop. Funds to cover the Milk Technicians salary, shop rent, chiller operations and other maintenance expenses (for one year) was given to community from the project fund.
- Visitors received information on milk collection process, lab test, manual milk testing and calculation of cost of milk price.
- The group learned about the challenges around quality milk collection.

Visit of cream separator

- Cream separator machine is available in the chiller room. Local milk collectors (Dhoodhi) bring milk to the chiller room for cream separation. 1-liter of raw milk, sold at about 40-42 rupees, is sold at 50-60 rupees in a nearby city, Burewalla, after it is turned into a cream.
- 1 kg of cream will be collected from 10 litres of milk. Cream is sold at 350 rupees per kilogram in big cities like Karachi and Lahore.

Awareness on saving system

- One to two rupees from each litre of milk of every FMC member were saved in bank account for future FMC interventions.

Visit to small scale farmers

- After detailed briefing about the FMC, small-scale farmers held a group visit and were educated about the dairy farming tradition in Punjab. Including, on the number of animals per farmer, breeds, milk production, seasonal fodder cultivation and preservations, veterinary services, and future planning.
- Visit small model dairy shed (sheltering 4-6 animals) established under PMVCP and owned by poor women to introduce advanced and modern dairy techniques to FMCs.

Visit to feed mixer

Plan International Pakistan under (PMVCP) provided a feed mixer to FMCs. Run by the community, the mixer was installed in a rented shop. Maintenance and running costs were covered by charging 50 rupees per 40 kg of ration mixed at the feed mixer.

Visit of commercial dairy farms

Commercial dairy farms visits were held involving demonstration of shed direction, shed construction, feeding table, showering system, teat dipping, milking machine, demonstration about silage and bunker.

Briefing about breed improvement and quality services from artificial insemination

- A detail briefing was given by the AIT on AI services to improve breeds for better production.

Visit of biogas plant

- Dairy and Rural Development Foundation (DF) provided a biogas plant to the Ghousia Farmer Managed Cooperative (FMC-569/EB), so that the electricity expenses of the chiller could be minimized.

Challenges, lessons learned and suggestions

Challenges

- Chiller shop rent (big expense)
- Lack of proper saving
- MT salary issues
- Dhoodhi’s adulteration issues
- Lack of trust of farmers on the set up of FMCs
- Initial expenses farmer had to pay
- Low milk prices specially in flush seasons
- Unavailability of processors in nearby location (no pasteurization plant)
- Currently FMC s have no financial support
- Less awareness regarding value addition techniques

Lessons learned

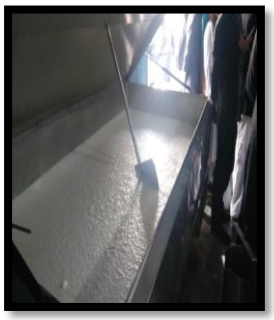
- Within the past 10 years, Livestock and Dairy Development Department along with other stakeholders and NGOs (Plan Pakistan, Dairy & Rural Development Foundation (DF), National Rural Support Programme, Punjab Rural Support Programme (PRSP) and Punjab Skills Development Fund (PSDF) and other local organizations) has been promoting livestock farming in Vehari and its surrounding areas.

- Due to these awareness programmes, residents of Vehari and its surrounding adopted modern dairy farming practices.
- People adopted many advanced livestock farming techniques.
- Cultivate and preserve improved fodder.
- Due to changes in livestock farming, better health and more production with quality breed were achieved.
- L&DD and other stakeholders started providing quality and timely services to the FMCs/communities.

Suggestions

- Before establishing any MPG, strong and quality selection of milk pockets and needy community is required.
- All stakeholders must be consulted before finalizing a milk pocket to locate the MPG.
- Milk pockets are available but change of structure of dairy business and proper marketing channels is required.
- Governments of Sindh (Livestock Department) should introduce a centralized farmer data capturing system like the one introduced in Punjab province (Punjab Livestock Model) so that immediate action can be taken in case of delayed service delivery.
- Provide awareness on improved fodder system.
- Provide silage machine (chopper) for silage making facilities in MPGs.
- Introduce saving system in MPGs.
- Sindh Government should set up processes for smooth running of MPGs.
- Organise exposure visits for interested farmers to nearby local commercial dairy farms to promote commercial dairy farming
- Timely delivery of veterinary services in MPGs.
- Focus on record keeping.

Pictures showing milk collection and testing (photo credit: SAGP-L).



Silage bunker (photo credit: SAGP-L).

Visit to dairy farms (photo credit: SAGP-L).

Other capacity building initiatives

Capacity building activities on Silage making

Training on 'silage making' was provided for dairy value chain stakeholders in Sindh on 29 December 2017 and at district Umerkot and Shaheed Benazirabad on 4 May 2019. The training was conducted by ILRI in collaboration with Pioneer Seeds Pakistan Limited and with Corteva. Latest farming techniques and advanced research-based knowledge was shared with participants.

Table 10 Participants at the 2 trainings programs held on silage making process

	District	Date	Venue	Total Participants		Total
				Men	Women	
1	Umerkot	29 Dec 2017	Dars Livestock Farm, Umerkot	46	04	50
2	Shaheed Benazirabad	04 May 2019	Zain Shah Farm	44	04	48
Grand Total				**90**	**08**	**98**

A workshop on silage making was the first training conducted by ILRI and SAGP-L at Dars livestock farm. In his opening remarks, Mr Ghulam Akbar Dars welcomed all participants and said that silage making is being used in Pakistan to overcome ought by saving extra fodder crops for the future us. He added that using silage has improved production than wheat straw or other fodder crops. Animals on Dars farm are producing 16 litres of milk per day using silage feeding. They produce 8 litres of milk per day while being fed wheat straw or other fodder. He expressed his hope that after this workshop farmers will make silage at their farms and realise increased milk production.

Another workshop on silage making was conducted by ILRI and SAGP at Murtaza livestock farm. Welcome speech was given by Syed Zain Shah, owner of Murtaza livestock farm. He said that silage is being used to feed animals in Murtaza livestock farm.

In both workshops, silage making process was explained by Shahid Khan, Consultant, where he highlighted the importance of silage.

Shahid Khan explaining the procedure in making silage (photo credit: SAGP-L).

He also stressed the importance of making good quality silage and factors affecting silage making process. He explained the steps involved in silage making (selection of the crop, harvesting, chaffing to ideal size, filling, pressing). He reiterated on the importance of stressing a bunker and pressing a silo to avoid the growth of pathogenic bacteria that will give the silage bad flavour and smell. But if silo is properly pressed, the anaerobic bacteria will preserve the silage and make it palatable and digestible and smells nice and liked by the animals. He further noted that, after the pressing, proper sealing is a must to preserve the quality of the silage. Sealing can be done by mud, bailing process, or sealing in plastic bags. Sealing should be kept for a period of six weeks before opening. Once opened and the needed quantity taken, it is important to close the bunker/bag properly to prevent deterioration.

Following the silage making training, cultivation of corn crop and technical points crop seed selection was conducted by Irshad Korejo from Pioneer Seeds Pakistan Limited and by Irshad Korejo (Area Forages Manager from Corteva Limited) at Shaheed Benazirabad program. The trainers covered selection of seeds and the type of hybrid seeds available for silage production. Korejo in his part shared that inoculant must be used as additives in making silages properly.

Thereafter, field visit was undertaken to see how silage is made at Ghulam Akbar Dars farm. Cutting and chopping and filling and pressing in the bunker were demonstrated.

Demonstration of the silage making process at Ghulam Akbar Dars farm (photo credit: SAGP-L).




Another silage making workshop was conducted by ILRI and SAGP-L at Murtaza livestock farm.
Welcome speech was given by Syed Zain Shah. **Shah** said in Sindh only few are making silage and are to fulfil the farm animal requirement and save the crops for future purpose.
After the technical sessions, participants went out into the field to witness the practical steps involved in silage making including demonstrations on chopping, filling in the bunker, pressing and spreading inoculants to make the silage tastier and more palatable for animal feeding.

Demonstration of the silage making process at Syed Zain Shah farm (photo credit: SAGP-L).






Kumar concluded the session by providing a briefing on the Agri NIR[3] machine and how it is used to evaluate the quality of silage in just 60 seconds. Analyses were performed using Agri NIR and the printed results were shown and discussed with participants.

Training workshop on the Feed Assessment Tool (FEAST)

Training on FEAST was conducted from 22 to 24 January 2018 at Crown Hotel, Hyderabad and attended by 30 participants from the Sindh LD and SAGP. Ibrahim gave an overview of ILRI's work in Pakistan in the past four years. He emphasized on the importance of the training on FEAST, a feed assessment tool, developed by ILRI and successfully tested in other countries.

The topics covered include:

a) The FEAST concept
b) Preparing for farmer centred diagnosis and
c) Focus Group Discussions

After the technical session, participants were split into two groups and sent into two different villages for field exercise (group discussion and individual interviews). One group, led by Ibrahim, visited the Ghazi Khan Almani village and the other group, led by Lukuyu, visited Gul Lashari village. Both groups entered data on forms. And on the third day, participants entered the data on the FEAST software. Participants were trained on analysing data and making comprehensive report after taking data from the field. They also experienced how FEAST facilitator can help farmers by providing solutions which can be implemented in the field.

Participants at the FEAST training workshop conducted by Ben Lukuyu

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Farmer participatory trial: Free access to inking water and roughage

Water deficiency in animals leads to less intake of feed, decrease in production of milk, constipation, weakness, increase in quantity of urea in urine and bad smell and incomplete digestion. Furthermore, adequate supply of both energy and protein is essential for the general health of animals. It is also observed that farmers usually offer water only one or two times a day, and feed their animals limited amounts of roughages, which are not sufficient to fulfil the daily animal requirements especially for milk production. To demonstrate the importance of free access to water and roughages, a farmer participatory trial was conducted at MPG Bhaloo Bhatti involving 2 farms.

The objectives of the trial were:

1. To compare the effect of free access to water versus restricted provision of water on milk yield and animal health (body condition scoring and udder health).
2. Quality of water and effect of water availability on milk yield.
3. To compare the traditional feeding versus feeding of Jantar and its effect on milk production and animal health.

Methodology: Eleven lactating animals (3-5 months in lactation) were selected from 2 households from Bhaloo Bhatti village. The animals were tagged, and their body weight was estimated by using the body weight measuring tape[4]. All animals were drenched. Also, faecal samples were collected and sent to Central Veterinary Diagnostic Laboratory Tandojam for the analysis of worm infestation. All data collected were recorded in data sheets (water consumption, feed consumption, milk yield and milk quality analyses).

The three phases of the trial

[4] Tape to estimate body weight of the animal

Phase 1: Collection of preliminary data on daily routine practices on farms (7 days)

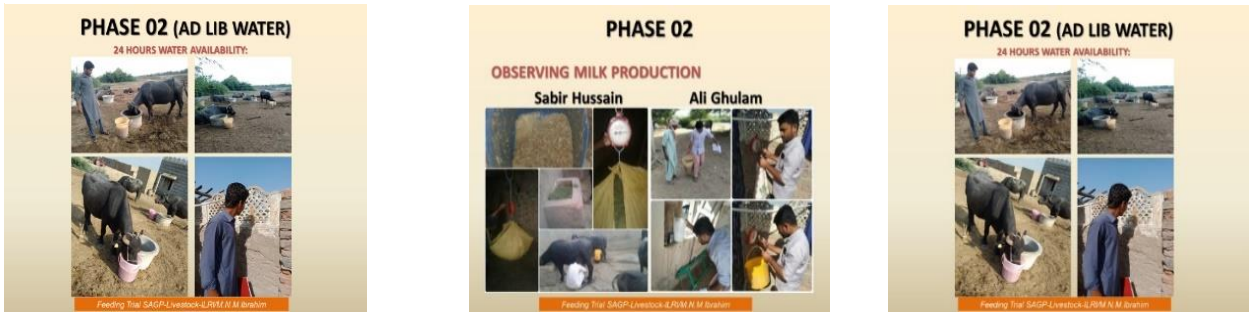
All the animals were observed and daily milk production, watering regime and feed offered and refused recorded. Farmers were also trained on body condition scoring method.

Preparation and preliminary data collection before start of trial

Phase 02: Provision of free access to inking water (day 8 to day 14)

All 20 animals were given free access to water 24/7. Water and feed intake daily and milk production were recorded.

Figure 8 Milk Data collection after offering free access to inking water



Phase 3: Provision of free-access water and roughages (day 15 to day 20)

Ad libitum feeding of the feed offered and ad libitum water offered as in phase 2. Water and feed intake and milk production were recorded daily.

Figure 9 Milk Data collection after offering free access to inking water and feed

Results showed clear increase in the milk production during the second and third phases of the trial.

- Free access to inking water during the second phase led to increase in milk production of about 0.1 litre per animal/day.
- In addition to their routine practice, addition of the Jantar forage on phase 3 also led to increase in milk production by up to 0.4 litre per animal/day.
- At MPG level, the milk increases will lead to daily increase in milk of about 42 litres from 84 milk animals belonging to the MPG members.
- From these 42 litres, increase in milk per day, annually it will be of about 15,330 litres increase in milk from MPG level and about extra 766,500 PKR generated annually from the same milk on selling at average rate of 50 PKR per litre annually.

Figure 10 Charts explaining the details of the feeding trial and response achieved on Milk production

As a follow-up of the trial, a workshop was organised on 15 October 2019 to share the outcome of the trial with members and non-members of the MPG Bhaloo Bhatti at District Mirpurkhas. It was attended by 179 famers.

Ali Ghulam and Mohammad Sabir, farmers where the trial was conducted, were invited to share their experience. Mr Ghulam shared that before the trial, he had limited knowledge on the importance of inking water and sufficient feeding of roughages for milk production. He now understands what he must do to increase milk production. He said before the trial his animals were not given water for the whole day and no green grass was given to animals (Phase 1), but during the 2nd and 3rd phase of the trial, he said, the milk production increased due to the just adlib water and addition of the Jantar. He was happy to learn how to properly measure

and record his daily income. Mr Sabir said he was feeding animals without the knowledge of the feed versus milk production ratio. But now he is providing feeds according to animal body requirement. He said that before the trial, he didn't check animals for worms but during the trial animals were checked for worms, drenched, and checked for the sub clinical mastitis via mastitis detector.

The MPG members thanked ILRI for providing the specially designed milk-in cans which will help them to produce clean milk and check for mastitis.

Figure 11 Parts of the specially designed milk can and demonstration

Training on rhodes grass production

A training on 'rhodes grass production and hay making technologies' was conducted by ILRI in collaboration with Farm Dynamics Pakistan at Fakir Muhammad farm in Gul Lashari on 17 October 2018. MPG members of Gul Lashari, Haji Ghazi Khan Aalmani and Wanki Wasi and Livestock Department staff participated.

Workshop participants (photo credit: SAGP-L).

Khan, ILRI staff, explained that the main objective of the training was to raise awareness on rhodes grass fodder and its importance to be used as a green fodder and its cultivation method. Fakir Muhammad is the farmer who was interested in rhodes grass and ILRI provided seeds free of cost for 0.5-acre land and now he is benefitting from it.

Mr Tahir Mustafa from Farm Dynamic Pakistan welcomed the participants and said that such training will build the capacity and help to overcome the nutritional deficiencies of cows. He explained the process of Rhodes grass cultivation from land preparation, sowing seeds, irrigation, and fertilizer application.

Field visit to demonstrate cultivation (photo credit: SAGP-L).

During the field visit, Muhammad shared his experience on rhodes grass cultivation under the guidance of ILRI, and now he is getting the green fodder from his land. It took Muhammad about 40-45 days for the first cut and thereafter at regular interval of 30 -35 days. He irrigated and fertilised the plot every 15 days. He emphasized that one should focus on the land levelling for even growth and production of fodder.

Training on biomass production from forages were also conducted to estimate the amount of green forage produced.

Ghulam Sarwar Dero, Deputy Director of Livestock at the Department of Livestock and Fisheries, in his concluding remarks said that he was pleased that such trainings are organised to raise awareness of the farmers and landlords to grow such type of fodder which has increased nutrient value and has an impact on animal health and its production.

As a follow-up of the training and requests from MPG members and others, 32 kgs (2 kg each) of rhodes grass (Tolgar variety) seeds were handed out to farmers by ILRI. This rhodes grass variety is also suitable for saline soils.

Table 11 Distribution list of tolgar rhodes grass seed farmers

S No	District	MPG	Name	Seed Distributed
1	Thatta	Thatta	Shahid	2kg
2		Khamiso Khan Samo	Mr Nisar Ahmed	2kg
3		Khamiso Khan Samo	Mr. Muhammad Hashim	2kg
4		M Saddique Baloch	Mr Muhammad Ibrahim	2kg
5	Hyderabad	Hyderabad	Prof Jaimal Dhanani	2kg
6		Haji Ghazi Khan Almani	Mr Ali Ahmed	2kg
7		Gul Lashari	Mr Fakeer Muhammad	2kg

8		Wanki Wasi	Mr Imam Bux	2kg
9	Tharparkar	Mithrio Soomra	Mr Abdul Aleem	2kg
10		Malnhor Khawairya	Mr Sawai	2kg
11	Mirpurkhas	Bhalu Bhatti	Mr Sajjid Manzoor	2kg
12		Bhalu Bhatti	Mr Makhtiar Ali	2kg
13		Muhammad Khan Lashari	Mr Niaz Ali	2kg
14	Umerkot	Habib Halepoto	Mr Haji Aleem	2kg
15		Habib Halepoto	Mr Allah Bachaio	2kg
16		Makhdom Talib Moula	Mr Menhal	2kg

National workshop on genetic gain in ruminants

National workshop on 'Genetic gain in ruminants was organized by ILRI at Indus Hotel, Hyderabad on 28 November 2018. The workshop was organised with financial assistance from Agriculture Innovation Program and SAGP and in collaboration with Pakistan Agricultural Research Centre, Universities, and livestock departments of various provinces in Pakistan. Both the Minister for Livestock, Fisheries and Cooperatives, Engineer Abdul Bari Pitafi and the Secretary-Livestock and Fisheries Department Government of Sindh attended the workshop. Professor Okeyo Mwai from ILRI was the main speaker. Representatives from Food and Agriculture Organization Pakistan, SAGP officers, director generals/Directors of Punjab, Sindh, Khyber Pakhtunkhwa, Balochistan, Gilgit Baltistan, Azad Jammu and Kashmir and Directors of Pakistan Agriculture Research Council, Professors of University of Agriculture Faisalabad, University of Agriculture Peshawar, Sindh Agricultural University Tandojam and Arid University, Rawalpindi, and various officers from Department of Livestock and Fisheries, Government of Sindh attended the workshop. A total of 72 participants attended the event.

Welcome addresses were given by Abdul Bari Pitafi, the Honourable Minister of Livestock and Fisheries and Mr Aijaz Ahmed Mahesar, Honourable Secretary of Livestock and Fisheries. The speakers appreciated the efforts of ILRI in organizing the workshop and its efforts in gathering representatives from all provinces/administrative districts. Ibrahim shared the objectives of the workshop which is to share the efforts regarding genetic potential gain activities across

National workshop on measuring genetic gain in ruminants opening ceremony

Pakistan and abroad and with these knowledge and experiences, to plan genetic gain strategies for various indigenous breeds of Pakistan.

Mwai delivered a presentation and shared the experiences of the African Dairy Genetic Gain program he is leading in Tanzania and Ethiopia.

He shared about a software his team developed to access real time data on breeding where data is entered through mobile sets and goes directly into the server.

Engineer Pitafi during his opening remarks said, ‘we have not worked in breeding section and that is why our per animal productivity is very low as compared to many countries of the world. Therefore, we must work in this component, and I hope with recommendations of this workshop, we would be able to start a good breeding program for our local breeds in Sindh’.

After lunch break, Director generals/representatives of all provinces/regions of the country shared their experiences and lessons learned from activities in their respective areas. A question-and-answer session were held facilitated by Muhammad Afzal. Mr Aijaz Ahmed Mahesar gave concluding remarks by thanking ILRI and participants. He said that it is high time to start breeding programs and shared his hopes that with the recommendations from this workshop, Pakistan would take the benefits of improving its indigenous breeds. Moreover, he committed to start breeding program of local breeds in Sindh.

Training on artificial insemination in goats

On 3 to 5 December 2018, ILRI in collaboration of Sindh Agriculture University (SAU), Tandojam, organized a training programme on Artificial Insemination in goats for the Sindh Government nominated 27 veterinary staff at the department of animal reproduction.
Ibrahim gave away a mini tube ultrasound machine to SAU for conducting Ultrasonography in Goats.
The three-day training session was led by Pershotam Khatri. It involved theoretical and practical demonstrations. Participants were provided with accommodation services at the teachers hostel of Sindh Agricultural University Tandojam. At the end of the session, certificates were distributed by Jameel Ahmed Sheikh, the Executive director Animal Breeding.

Group photo of the participants and awarding of certificates to the trainees (photo credit: SAGP-L).

Impact of ILRI's capacity building activities

Capacity building activities for improving feeds and feeding practice

- Importance of offering water to animals enhanced and farmers who were previously offering water once or twice a day, are now providing water according to the weight of animals. Most importantly, farmers have seen increase in milk production by increasing more water to the dairy animals.
- Farmers are now getting green fodder for longer periods by cultivating multi-cut grasses like rhodes and mott grass.
- With the use of feeding charts of milking cows and buffaloes, many farmers are now providing grasses and balanced ration according to the weight and production of the animals.
- Farmers are now more sensitized about the importance of proper feeding and improved feeds to all age group of animals, because it directly affects the growth, reproduction, and production of their animals.

Capacity building activities for improving animal health management

- Awareness about 'biosecurity measures' for prevention of diseases has improved and farmers are now vaccinating and deworming their animals against contagious diseases on a timely basis.
- Recognition about signs and symptoms of common diseases have improved, which is important in the control of diseases.
- Zoosanitary measures have been enhanced. Which is important in case of facing any contagious disease and is mainly the responsibility of farmers.
- Knowledge about proper housing has enhanced which is useful to protect animals from extreme weather, should be clean and allows for access to water.
- Record keeping on preventive, treatment and breeding has improved following the introduction of health card to each farmer and health register at each MPG.

Capacity building activities for improving reproductive health of animals and breed improvement

- Knowledge about the importance of taking care of reproductive cycle of cows/buffalos has been enhanced following the introduction of the 'cow calendar'.
- The cow calendar developed by ILRI was appreciated by all stakeholders of the project for its convenience in obtaining information on reproduction and breeding dates of animals.
- Enhanced the knowledge about proper bull selection for breeding purposes and adaptation of AI and pregnancy diagnosis.

- Enhanced the knowledge about the importance of proper selection and culling of animals for profitable dairy business.

Outputs of ILRI's capacity building activities

ILRI initiated its activities with the launch of inception workshop in October 2017. The inception workshop report was submitted to the SAGP-L PMU in October 2017 which was officially accepted in January 2018.

- ILRI trained all stakeholders (provincial, district and district field staff, dairy farmers) involved in dairy value chain on animal health, feeds and feeding, reproduction and breeding, animal management and housing. In total 448 training programs were conducted, which is 3 times more than what was planned. More than 15,022 participants have benefitted.
- ILRI conducted 14 workshops, although it committed to hold 10 workshops. 1720 farmers participated.
- Other capacity building activities include (a) feeding trial with farmers to demonstrate the economic benefits of free access to inking water and feeds for dairy animals. Benefits of the trial was disseminated to 98 farmers in villages (b) conducted a training on FEAST to DoL staff and trainers (c) Promoted growing of grass (rhodes grass and mott grass) in farmers' fields and demonstrated the benefits of having a continuous supply of feeds for animals (d) Conducted 2 training programs on silage making where 98 DoL staff and farmers participated.
- Two international exposure visits to DoL and SAGP-L staff were planned. Out of which 1 visit to Kenya was executed. 15 DLS & F and project staff participated. The other trip to Sri Lanka, planned for end of end of March 2020, was cancelled due to COVID-19 global pandemic.
- 11 national exposure visits of the executive members of MPGs were planned. Nevertheless, 6 were completed by mid-February 2020 and the remaining 5 had to be cancelled due to the pandemic.

Training materials

The training materials are attached as annexes to this report

1. **Power Point slides**

   Training of Master trainers, DoL Provincial staff, and DoL District level staff on:

- Annex: Animal health management
- Annex: Feeds and Feeding Strategies
- Annex: Animal Reproduction, Genetics and Breeding

The above training materials were given as a handout to all trainees

2. **Panaflexes (3'x4')**

   Training of MPG members and non-members on:

- Annex: Animal health management
- Annex: Feeds and feeding strategies
- Annex: Animal reproduction, genetics, and breeding

Note: The above training materials were also given as booklets to farmers

3. **Charts**

- Annex: Guide for feeding cattle and buffaloes
- Annex: Cow calendar - guide for breeding

The above training materials were also given as a handout to farmers

4. **Factsheets (in Sindhi language)**
   The below factsheets were given as handouts to all trainees (Annex: Factsheets 1-10 (Sindhi))

   Factsheet no: 1. Digestion in the rumen
   Factsheet no: 2. Management of calves
   Factsheet no: 3. Management of heifers
   Factsheet no: 4. Oestrus cycle and heat detection
   Factsheet no: 5. The in-calf cow
   Factsheet no: 6. Fresh cow problems
   Factsheet no: 7. Management of y cows
   Factsheet no: 8. y cow therapy – Mastitis control
   Factsheet no: 9. Body condition scoring of dairy animals
   Factsheet no: 10. The process of milking
   Factsheet no: 11. Common diseases of Cattle & Buffaloes

Training manuals/books

1. E. Kang'the, S.A. Khan, M.N.M. Ibrahim and J.Githinji, 2020. **Training Facilitator guide on Animal Health Management**. Published by ILRI under the Sindh Agricultural Growth Project - Livestock Component (SAGP-L) assisted by World Bank pp.79. **ISBN: 978-969-7564-10-1.** https://cgspace.cgiar.org/handle/10568/112981

2. M.N.M. Ibrahim, E. Kang'the, S.A. Khan and J.Githinji, 2020**. Training Facilitator guide on Feeds and Feeding**. Published by ILRI under the Sindh Agricultural Growth Project - Livestock Component (SAGP-L) assisted by World Bank pp. 83**. ISBN: 978-969-7564-11-8.** https://cgspace.cgiar.org/handle/10568/112974

3. E. Kang'the, M.N.M. Ibrahim, S.A. Khan and J.Githinji, 2020**. Training Facilitator guide on Animal Reproduction and Breeding**. Published by ILRI under the Sindh Agricultural Growth Project - Livestock Component (SAGP-L) assisted by World Bank pp. 45. **ISBN: 978-969-7564-12-5.** https://cgspace.cgiar.org/handle/10568/112976

4. Published an illustrative compendium on “Feeds and Forages for Ruminants in Pakistan”, for easy identification of feeds by extension staff and farmers. (M.N.M. Ibrahim 2019. **Compendium of Forages and Feed Resources for Livestock Farmers in Pakistan**. pp. 119. **ISBN: 978-969-7564-08-8**) https://www.scirp.org/journal/paperinformation.aspx?paperid=21360

5. M.N.M. Ibrahim (2018). Feeding Dairy Cattle and Buffaloes: Training Manual for Extension Worker in Pakistan, Sindhi Language. (pp. 92). International Livestock Research Institute (ILRI), Pakistan. **ISBN: 978-969-7564-02-6**. https://hdl.handle.net/10568/112974

6. Ibrahim, M.N.M (2020). Feeding of Dairy Cattle and Buffaloes in Pakistan: ‘A Practical Guide’. pp 95. International Livestock Research Institute (ILRI), Pakistan. **ISBN: 978-969-7564-01-0**. https://hdl.handle.net/10568/112974

7. **Annex:** Glossary of technical terms used in animal science - English and Sindhi.

Project reports

1. Report 1: Inception workshop report .
2. Report 2: Training of District Livestock Department, SAGP-L and ILRI staff (DDL, ADL, VO’S, DFM’S, LLS & ILRI National Staff) on Dairy Production Technologies
3. Report 3: Training of District Field staff (AI Technicians, Livestock Inspectors, Stock Assistants, Lab Technicians) on Dairy Production Technologies.
4. Report 4: Awareness program on farmer participatory trial (hands-on training) on free access to inking water and feeding strategies on milk production conducted at Bhaloo Bhatti mpg; district Mirpurkhas.
5. Report 5: Training Report on MPG member trainings on animal production and breeding

Assets

All fixed assets purchased under the SAGP-L project can be found in Annex - Handing over assets, training, publication materials, receipts and Annex - List of fixed assets received from ILRI. In total 91 items worth PKR 2,946,086 were purchased. All these items were handed over to PMU/SAGP-L.

Exit strategy and sustainability

All stakeholders at provincial, district and field levels were trained. Refresher trainings have also been conducted. Stakeholders have the required skills and training materials to pass on the knowledge gained to others.

1. Appreciation letters informing that the capacity building activities of ILRI under the agreement with SAGP-L has come to an end as of 30 June 2021 was sent to all stakeholders/partners (Secretary/MLS&F, DG/DLS, Directors/DLS, D/DD of the project districts, PC/SAGP, PD/SAGP-L, DFMs, LLS, SAU Tandojam). Together with the letter, a list of all publications produced by ILRI-Pakistan and hard copies of the training materials produced under SAGP-L were sent.
2. All the above stakeholders were trained by ILRI staff on communication techniques, and on feeds and feeding strategies, animal health management, reproduction, genetics, and breed improvement strategies. They were also involved in finalizing the training materials used for trainings and on the three Training Facilitation Guides produced by ILRI for SAGP-L. ILRI is confident that with the trainings provided, partners/stakeholders are able to train non-project districts staff and new staff recruited to the DoL.
3. Formal and hands-on trainings imparted to field level district staff (VOs, Livestock Assistants, AI Technicians, and CVDL staff) by ILRI staff and district/project staff enables DoL district staff to undertake such trainings to other villages in the district and to train staff from non-project districts. Copies of all training materials used (Flexes, Fact sheets, manuals) including mega size feeding charts and cow calendar were handed out and will be useful tools to conduct such trainings.
4. The interactive trainings (more than 1200) conducted for members and non-members of the 153 MPG have raised awareness on strategies to increase milk production through better feeding practices and better animal health and reproduction/breeding practices. Hands-on trainings were conducted on feeds & feeding strategies.

Sustainability of SAGP-L activities

- Knowledge imparted via trainings, awareness programs and exposure visits to trainees would enable them to implement day-to-day livestock extension (DoL staff) or livestock keeping (farmers) activities. However, it is important for the

district staff to monitor the farmers, and if needed provide some refresher trainings.

- The MPGs formed are only 2-3 years old and it is too early to be independent. To ensure sustainability of the project efforts, the MPGs should be nursed by the DoL district staff at least for an additional period of 3-4 years.
- As there were conflict issues with some MPGs, refresher trainings on benefits of working as a group and on conflict resolution would be highly beneficial for smooth running of the MPGs.
- Of the 153 MPGs, only about 25 have been registered with the district social service and cooperative departments. As the project ends, this responsibility must be taken over by the DoL.
- More trainings on milk collection and testing are needed for smooth running of the chilling centres established at MPG level.

Budget and financial status

1. From the contracted amount allotted to ILRI (**US$ 1,295,122**) the actual expenditure at project close is USD 1,173,308 (Annex - Finance appendix C&D and Annex - SAGP 001 June 2020 financial report), accordingly USD 121,814 is recorded as budget balance.
   Table below gives the details of invoices submitted to SAGP-P and reimbursements received from World Bank.

Details of invoices submitted and Reimbursements from SAGPL/World Bank

Description	**Bills Submitted (expenses)**	**Reimbursements/Receipts**
Advance as 10% of Total Agreement		129,512.20
Expenses (October 15,17 to May 31, 2018)	172,647.05	155,382.34
Expenses (June 01,18 to September 30, 2018)	124,588.55	105,783.70
Expenses (October 01,18 to April 30, 2019)	346,053.05	281,919.24
Expenses (May 01,19 to May 31, 2019)	27,244.82	95,389.41
Expenses (June 01,19 to September 30, 2019)	129,156.39	
Expenses (October 01,19 to February 29, 2020)	212,769.60	118,345.13
Expenses (March 01,20 to March 31, 2020)	41,248.78	
Expenses (April 01,20 to May 31, 2020)	56,024.48	
Expenses (June 01,20 to June 30, 2020)	63,575.30	
Total	**1,173,308.02**	**886,332.02**

1. As per table above, the funds not reimbursed amounts to **USD 286,976.00.** In the final reimbursement of funds sent to us in June 2021 **(**Annex - Final reimbursement and tax deposits)**, USD 285,695.65** has been deducted as taxes (US$ 117,329.79 as 10% WHT; and US$ 168,365.86 as 13% Sales Tax), and the difference of US$ 1,280.35 is to be reimbursed.
2. In the past 1.5 years, even though ILRI provided sufficient information to the ex-procurement and ex-finance officers of PMU (both were discontinued as of 30 June 2021), that ILRI is registered as a non-profit organization/company with FBR as such the WHT should be 8% and not 10% as used in the final calculations. ILRI has also communicated to PMU/SAGP that if it is mandatory for payment of sales tax, it should on the funds expensed, and not on the contractual amount. (Summarised in Table below):

Deductions as taxes & unsettled bills	
Income tax (10% of expensed amount)	117,329.79
Sales Tax (13% of contracted amount) *	168,365.86
Total deducted as taxes	**285,695.65**
Unsettled dues to be reimbursed	1,280.35
Total deductions	**286,976.00**

*** Sales tax should be calculated based on expensed amount (it should be USD 152,530.04), amount to be reimbursed = USD 15,835.82**

3. At the time of signing the agreement with SAGP-L, ILRI was not aware that it is liable to pay income and sales tax on its expenditure since this is not normal practice. No taxes were included in ILRI budget of $1,295,922 and no information was provided by SAGP to indicate this was an omission. ILRI was informed about the taxes especially the Sales Tax only on 15 Dec 2020.
4. In the past 1.5 years, even though ILRI provided sufficient information to the ex-procurement and ex-finance officers of PMU (both were discontinued as of 30 June 2021), that ILRI is registered as a non-profit organization/company with FBR as such the WHT should be 8% and not 10% as used in the final calculations. ILRI has also communicated to PMU/SAGP that if it is mandatory for payment of sales tax, it should on the funds expensed, and not on the contractual amount.
5. In the last email received from Javed (DPD/SAGP-L) on 20 November 2021, ILRI was informed that the project is closed, and deducted taxes were deposited well in time to the relevant authorities (Annex - Final reimbursement and tax deposits). According to the slips received Income tax of PKR

18,027,218 (US$ 117,329.79) was deposited on 31 May 2021, and Sales tax of PKR 26,130,377 (US$ 168,365.86) was deposited on 17 June 2021.

6. As per above the financial loss to ILRI in assisting SAGP-L with capacity building activities is USD 286,976.00.

Annexes

Annex: Animal health management: https://hdl.handle.net/10568/112981

Annex: Feeds and feeding strategies: https://hdl.handle.net/10568/112974

Annex: Animal reproduction, genetics, and breeding: https://hdl.handle.net/10568/112976

Annex: Feeding chart Sindhi

Annex: Cow calendar

Annex: Factsheets 1-10 Sindhi

Annex - Compendium of forages and feeds

Annex - Feeding dairy cattle and buffaloes manual – Sindhi

Annex - Feeding dairy cattle and buffaloes in Pakistan-A practical guide

Annex: Glossary of technical terms used in animal science - English and Sindhi

Annex - Handing over assets, training, publication materials and receipts

Annex - List of fixed assets received from ILRI

Annex - Finance appendix C&D

Annex - SAGP 001 June 2020 financial report

Annex - Final reimbursement and tax deposits