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Observations on cattle dairy breeds in Pakistan; need to curb unseen economic losses through control of mastitis and endemic diseases*

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Abstract: In October 2005 a devastating earthquake caused extensive damage among populations in Pakistan administered Kashmiri Region and parts of North Western Frontier. In addition to the loss of more than 87`000 human lives and 70`000 injured, many livestock namely buffaloes, cattle and goats were lost. This eroded the livelihoods of families that solely relied on livestock and agriculture for their economic survival.
The International Committee of the Red Cross together with the German Red Cross (ICRC/ GRC) and the Kashmiri authorities formulated a project that sought to restore the livelihoods of the most vulnerable households to a level comparable to before the earthquake. The project adapted an agro-vet and micro-economic approach, part of which included the provision of a milking cow and calf.
This report indicates that antibiotics and homoeopathic medicines provide similar levels of protection against mastitis (Spranger, 2000). Preventive measures like vaccinations, disinfectant footbaths and reducing stress during the critical time of calving goes a long way towards improving the overall health of the dairy cows (Dettloff, 2005). Although milking is in many cases still done by hand, pre-milking and post-milking hygienic procedures, such as udder washing and drying greatly decrease prevalence of mastitis.

Keywords: Dairy cattle, breed colorations, mastitis, Pakistan

* A Red cross livestock distribution project 2007

Background

There are over 24 million cattle in Pakistan; 46% of which are in Punjab Province, Sindh has 26%, NWFP 21%, Balochistan 6% and Northern areas nearly 2% (Ministry of Agriculture Livestock Census, 1996).

About 75 per cent of the rural population are dependent on livestock rearing for their livelihood (Junejo, 2007). Livestock contribute about 9.4 per cent to the Gross Domestic Product GDP, and 40 per cent value addition to agriculture sector. More than 90 per cent of the farmers are small holders and own about 1 to 4 animals.

The per capita per annum availability of milk in the country is 80.5 litres, with over 31 million tons of milk produced during 2005-06 making Pakistan the 5th largest producer of milk in the world. Its yield per animal however is only one fifth that of Western Europe (Ali Tanvir). The dairy industry of Pakistan is constrained by a number of factors that include: low genetic potential of animals, poor animal health, improper feeding and housing for animals, insufficient transportation and low quality of milk. Lack of commercial dairy farms is also a limiting factor to the dairy sector in Pakistan.

Introduction

Livestock are also assets; ways of storing and transforming wealth so as to generate income, or to smooth out sharp variations in income and consumption on account of such natural disasters and economic shocks(Government of Pakistan, 2003). It has been estimated 70% of poor and food insecure people reside in rural areas and depend directly or indirectly on agriculture for their livelihood (Ali Muhammad Amjad *et al.*, 2007).

In line with meeting the objective of ameliorating some of the effects of the disaster the project tendered, procured and distributed milking cows with their calves to pre-selected beneficiaries.

Households that were classified as vulnerable included households that had:

1 - Either lost all animals in the EQ and were not able to rebuild these assets on their own
2 - Households headed by widows,
3 - Or poor HH that never had owned animals pre- EQ but had dependent children 12 years old or less.

The criteria were kept flexible as the communities were slowly recovering and some were able to afford milking goats but were still in need of a dairy cow.

Beneficiaries are linked to a local community animal health worker and the restocking programme was confined to a community animal health worker training programme. Necessary training on management and proper nutrition was also provided to beneficiaries prior to receiving the dairy cow.

Methodology

In 2007, 2,109 cows and their calves were purchased, by contracted suppliers, from markets in Punjab and NWFP Provinces. The cattle underwent a validation screening process before delivery to the ICRC/ GRC distribution point in Kashmiri Province.

The source of animals was an issue as not enough numbers could be procured around the disaster affected area. The provision of lowland cattle into highland areas is subject to challenge especially regarding their adaptability to altitude, climate and the scarce feed resources.

The supplier companies, namely Fawad Steel Corporation FSC, Hassan Enterprises HE and Green Services Sector GSS setup their validation centers in Lahore, Rawalpindi and Peshawar. Cows were trucked in from Punjab livestock markets in Sahiwal, Okara, Gujranwala, Sialkot, Sheikhupura, Chichawatni and Multan among others while in NWFP cattle came from Peshawar, the Swat valley and Gilgit. The project interventions tried not to disrupt normal activities at livestock markets nor contribute to increase in prices or artificial scarcities of supply of animals to other buyers. Animals were purchased through suppliers on the various market days.

At the validation centres the pair of dairy cow and calf was inspected for conformity to specifications on suitable breed, age, weight (as larger cows were deemed not suitable in the high mountainous areas of PAK) and milk production.

Selection criteria

1 - Cows were chosen that exhibited dairy characteristics (small or no hump, good firm udder, long slim legs and good pastern area); initially crosses of the local *desi* breeds Cholistani, Lohani, Dhanni, Rohjan, Dajal with improved breeds like Sahiwal, Jersey or Friesian were accepted but this was later refined to select animals that exhibited unambiguous Sahiwal or Jersey characteristics and qualities (i.e. animals that possessed more of either Sahiwal or Jersey features than traits of any of the other local breeds).

2 - Cattle were required to have between 220 - 390 kilograms body weight

measured using a calibrated Rondo® combined measuring tape (Weight estimation using tape Rondo). The chest circumference of the animal was measured behind the humps of the elbow joints and the weight reading taken directly from the conversion on the reverse side. The expected accuracy is within 5% of actual body weight especially for animals that had completed a long journey from markets.

3 - Cows had to be in early lactation stage i.e. nursing its own calf aged 1 - 10 weeks old and consistently yielding a minimum of 5 litres of milk per day after nursing the calf (extracted milk was observed and recorded over at least three consecutive milkings). The milk obtained during the monitoring was sold, by the suppliers, through middlemen or *'Dodhees (Gawalas)'* or given to neighbouring poor families.

4 - Cows were checked for general health and had to be free from diseases and disability including, but not limited to udder, locomotion and vision problems. The California mastitis test (CMT) was used to check for evidence of mastitis (Radostits *et al*., 1994). A reagent dye and test paddles, manufactured by Bio vet® Kruuse Denmark, were used as an accurate and economical method of determining cell count in milk as higher cell counts indicate mastitis. A small amount of milk was squeezed out of each teat into the corresponding quarter of the paddle; excess milk was poured out to leave just 2 ml. This was critically checked for inconsistencies in colour, evidence of blood, mucus, clots etc. 3 ml CMT reagent was then added to the milk. Change in colour and consistency for positive mastitic milk varied from slight mucous light pink coloration to almost jelly-like thickness with a deep purple colour. Exceptions were cows in first 3 days of lactation as the colostrum gave a similar clot/ colour reaction as mastitic milk but was consistent in all quarters as opposed to mastitis that tended to affect in many cases individual quarters.

5 - The cows had to be between 3.5 to 7 years of age. This was estimated using dentition as described by FAO (FAO, 2005). This proved useful and accurate and was corroborated in few cases by cows coming from commercial farms that had been branded with their year of birth.

6 - All cows were vaccinated against the endemic diseases, specified by the Department of Animal Health and the project, by a qualified and authorised professional and bore official vaccination certificates issued by the relevant department. It was essential to do this before transportation to avoid outbreaks of disease between the herds and transmission to new herds. Foot and Mouth Disease FMD polyvalent oil adjuvant vaccines (Merial Animal Health Ltd.) by Merial®and Haemorrhagic Septicaemia HS mono-valent oil adjuvant vaccines

manufactured locally in Pakistan by the National Veterinary Research Institute (NVRI) and the National Institute of Animal Biosciences (NIAB) were used.

For the purposes of the report analysis of the records was done using Epi Info[1] and charts and tables done in MS Excel or MS Word directly. In total records from 2,109 lactating cows with their calves were analyzed.

Results and principal findings

A recent evaluation showed the animals distributed into PAK from Punjab last year suffered no adverse effects as they easily adapted to the new environment. The changes made *vis a vis* the project approach used in 2006 doubled milk production and reduced calf mortalities among livestock distributed to beneficiaries (ICRC, 2007).

Breed colouring

The Sahiwal breed of cattle are found in Punjab Province and are renowned for their heat and tick resistance and have contributed in the formation of many

Figure 1 - Sahiwal cows at a validation centre

synthetic crosses in the tropical regions of the world.

Their average milk production per lactation is about 1,200-1,800 liters with 4.5% butter fat. The age at first calving is more than 3.5 years and calving interval ranges between 1.5 to 2 years.

Semen from selected Friesian and Jersey bulls raised locally is produced at

[1] - Epi-info 1996 Centre for disease control, version 6.04d, Atlanta, USA and Geneva, Switzerland

Semen Production Units (SPU) at various Departments of Animal Husbandry (DAH) centres in each Province and has been distributed in upgrading programs for the last 15 years(Malik Sajjad Zaheer, 2003). As evidenced in several cows some Jersey cross-breds produce the wild-type pigmentation and tended to manifest only with the dark extremities (head, neck, feet and hindquarters) while having various body colours but all their calves are consistently born with a

Figure 2 - Some Jersey cross cows presented at the cow centres

reddish brown hue (Olson).

The Dhanni, Dajal and Rojhan are draught type breeds with milk production potential of 800-1000 liters per lactation. Utility of these draught breeds has declined over the years due to increased mechanization in agriculture. The production recording and progeny testing program is being executed for the Sahiwal breed only and is limited to institutional herds.

These local desi breeds showed remarked spotting patterns; Dhanni which is predominantly white with small black body spotting, black ears and a black muzzle, the Lohani with remarkable speckling throughout a brown body, and the Rohjan that appears to have a recessive spotting pattern (Olson).

Productivity parameters

All cows were required to be in early lactation; this was done through visual observation of the calf with special attention to remnants of the umbilical cord and body size. It should be noted that the cows needed the calf to suckle and stimulate milk let down before successful milking unlike in European breeds that are machine milked and do not need a calf nearby. Some unscrupulous traders artificially stimulate high milk production in cows by administering injections of

Figure 3 - Pure Dhanni cow and its calf

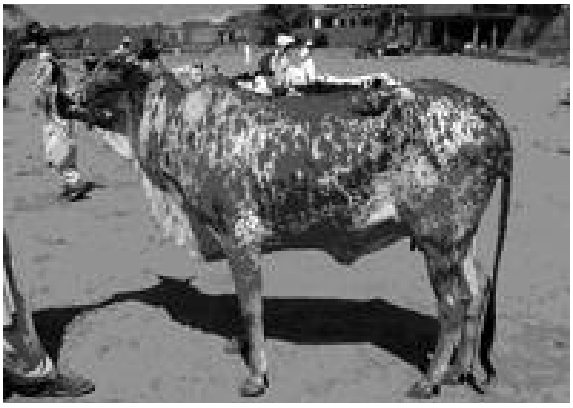

Figure 4 - Lohani breed of cattle

Figure 5 - Rohjani breed

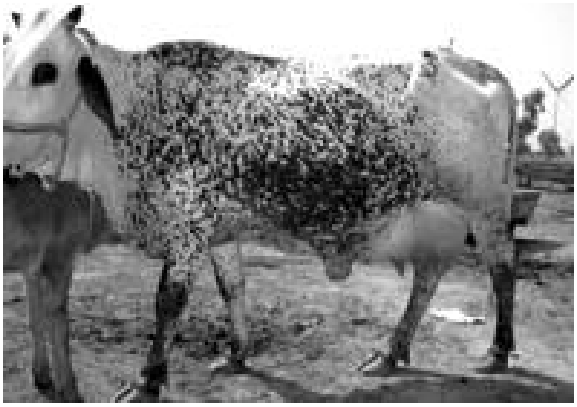

Figure 6 - Cholistani breed of cattle

Figure 7 - Dajal cross cows showing distinct grey body coloration (these cows also have characteristic bad temperament of the Dajal).

Figure 8 - The Achai breed of cattle displayed variation from the reddish color found in Swat valley to the pure black Gabrali Achai and the black with white frilly hairs on head and eyes found along the Chinese border.

Table 1 - Average body weight, milk production per day and efficiency index for each breed group

Breed	Total cows	Avg. body weight kgs	Std Dev	Avg. milk prod/ day ltr	Std Dev	Efficiency index milk prod/ body wt
Sahiwal	1,252	304.7	42.1	6.3	1.1	0.021
Jersey	335	295.2	42.8	6.5	1.2	0.022
Friesian	55	325.6	32.2	6.2	1.1	0.019
Achai	175	221.0	27.3	4.5	0.8	0.020
Cholistani	38	320.4	38.3	5.8	0.8	0.018
Dajal	51	308.3	42.7	6.0	0.9	0.019
Dhanni	79	315.7	40.1	5.6	0.8	0.018
Lohani	72	306.8	40.6	5.9	0.9	0.019
Rojhani	52	305.7	36.9	5.5	0.6	0.018
Total	2,109	300.4		5.8		

the hormone oxytocin but this is not long lived and soon declines.

From the data it is seen that 1,809 calves were aged 1 to 4 weeks, 260 aged more than 4 up-to 8 weeks and only 40 calves older than 8 weeks. The older calves were accepted exceptionally especially if the cow was a good milk producer and/or the calf was female. The ratio of male to female calves was near natural, 54.7% to 45.3% respectively, which was a marked improvement by the suppliers from the previous year. Coupled with the decreased calf mortalities and fewer reports of dams rejecting the calves at the Distribution point in Pattika it can be assumed that there was less of fostering and forced attachment of especially orphan male calves to dry cows a common practice among dishonest livestock traders.

As shown in the Table 1 the Achai breed was the smallest with an average of 221 kilograms (kgs) body weight followed by the Jersey crosses with 295 kgs. The largest proved to be the Friesians at 326 kgs, the Cholistani at 320 kgs, Dhanni 315 kgs with the medium sizes being the Sahiwal, Rohjani, Lohani and Dajal with average 304.7, 305.7, 306.8 and 308.3 kgs respectively.

An efficiency index (E.I) is developed when milk production is compared against body weight. The Jersey crosses proved to be more efficient giving on average 6.5 litres per day (E.I =0.022) followed by the Sahiwal with 6.3 litres (E.I =0.021). The Achai is known to be better adapted to the high altitude areas, grazes

freely and produces 4.5 litres per day (E.I =0.020) despite its small size.

The decision to drop the larger crosses from later selection criteria and concentrate on Jersey, Sahiwal and Achai crosses is justified given the limited natural feed resources and the mountainous terrain of many small farms in PAK.

Records of milk production were triangulated against age and plotted on an extrapolated graph for each breed. From the figure below the milk production increases from first calvers 3.5 years and peaks with cows on their third or 4th lactation (6 years and above). Farmers tend to sell their cows once they have

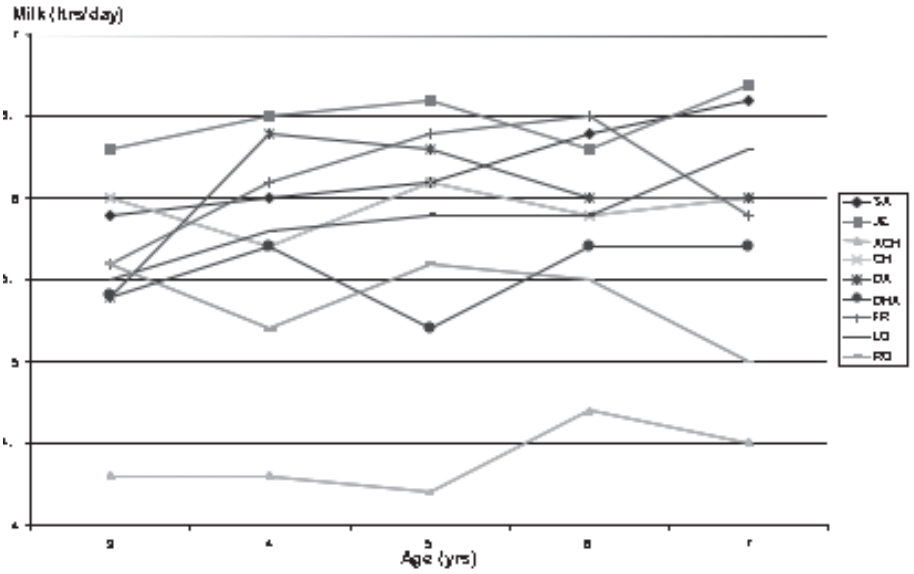

Figure 9 - Derived milk production curves for each breed

reached this peak and these where the most available cows on the market.

Mastitis

There is no standard definition of various types of mastitis but is simplest to consider mastitis as being either clinical or sub-clinical and symptoms may be classified as acute or chronic in nature (Raza Syed Hassan, 2004).

Clinical Mastitis

It is normally characterized by inflammation (heat, pain, redness and swelling)

of the udder. The udder secretion is usually abnormal; milk yield and quality are usually markedly reduced. Several factors influence the severity of the effects e.g. organism responsible, the susceptibility of the cow and the extent of udder damage. As the few cases found would be difficult to treat in the short time the cows spent at the validation centre these cases were rejected outright.

Sub-clinical Mastitis

Disease identification was made based on clinical examination, nature and appearances of milk secretion, and reaction to California Mastitis Test (indirect tests such as CMT, cell count or white side test are required to make the diagnosis). A quarter infected with a pathogen, having an increase in the cell content of the milk and the absence of clinical signs, is generally accepted as being affected with sub-clinical mastitis. The level of cell count regarded as significant varies with different workers, but counts in excess of 500,000 cells per ml are generally regarded as indicative of sub clinical mastitis. This form of mastitis is frequently not noticed by the farmer.

On the advice of the project veterinarian all cases of sub-clinical mastitis had to be treated, by the animal health attendants provided by the supplier, with a combination of Penicillin-Streptomycin injectable (Phenbiotic® 5 gms) and intra-mammary infusions of Gentamicin (Gentamast® 100mg) or long acting Oxytetracyclines (Oxtra LA® 20mg/ kg) and intrammamary infusions (Rasomycin® 426 mg). A third regime of homeopathic oral treatment Masti-vet® , with a composition of Bromium, Byronia, Chimaphila, Conium, Hypersulphuris and Kali Iodide was also used.

In total 215 cows were treated for sub-clinical mastitis and recovered while 66 were diagnosed as having clinical mastitis and therefore rejected.

From the table 2 it can clearly be seen the mastitis cases tend to increase with increased age of the cow with the prevalence of 15.26% mastitis in cows aged 6 years and above.

Table 2 - Prevalence of mastitis by age category

AGE GROUP	TOTAL	MASTITIS		PREVALENCE
	no. COWS	SUB-CLINICAL	CLINICAL	%
2.0 – 3.5 yrs	305	25	11	11.80
4 – 5.5 yrs	716	58	21	11.03
6 – 8 yrs	1'088	132	34	15.26
TOTAL	2'109	215	66	

Table 3 - Prevalence of mastitis cases by breed

BREED	TOTAL COWS	MASTITIS		PREVALENCE %
		SUB-CLINICAL	CLINICAL	
Sahiwal	1'252	150	40	15
Jersey	335	27	7	10.1
Friesian	55	5	4	16.4
Achai	175	5	0	2.9
Cholistani	38	6	0	15.8
Dajal	51	7	4	21.6
Dhanni	79	5	8	16.5
Lohani	72	8	2	13.9
Rohjani	52	2	1	5.8
TOTAL	2'109	215	66	

Table 3 shows that prevalence of mastitis by breed. The prevalence is lowest in the Achai (2.9%) that are raised in free grazing systems and highest in the Dajal 21.6% that is raised in semi-intensive systems with supplementary stall feeding. The crosses had reduced prevalence probably due to better management on the commercial farms where they are found. The majority had prevalence of 10 – 16% which compares to the average found in other studies. This substantiates the findings that mastitis is spread through dirty environment and poor milking techniques (dirty hands and containers).

From the results above all breeds of dairy cows are susceptible and no specific prevalence related to breed. It is generally thought that high producers are more commonly affected than poor producers. With succeeding lactations, the likelihood to have contracted infection increases. That is, more cows on their third or fourth calf than cows that just had their first calf are affected (Raza Syed Hassan, 2004). Where poor hygiene exists, housed cows are at greater risk of infection with environmental micro-organisms than cows on grassy pasture (Raza Syed Hassan, 2004). The prevalence of clinical cases increases with confinement; especially during the cold winter months.

With the treatment regime of Penicillin-Streptomycin injectable (Phenbiotic® 5 gms) and intra-mammary infusions of Gentamicin (Gentamast® 100mg) or long acting oxytetracyclines (Oxtra LA® 20mg/ kg) and intrammamary infusions (Rasomycin® 426 mg) it took about 3 days for the mastitis to clear while it took only a day for the homeopathic treatment.

In terms of cost the first regime of the Phenbiotic® 5 gms and a tube of Gentamast cost 164 PKR, the second regime of a 100ml bottle Oxtra LA and

Rasomycin tube cost 285 PKR while with the third regime of using a 240 ml bottle of homeopathic treatment only cost 180 PKR.

Discussion

Cross breeding in cattle has been going on for the last three decades. Production potential of the resultant crossbreds is much higher (may be double) than that of the local dairy breeds (Malik Sajjad Zaheer, 2003). The Punjab breeding policy seeks to maintain pure bred stocks of the Dhanni, Dajal and Rojhan breeds is to keep them as purebreds and it prevents crossbreeding with any other local or exotic breed. Crossing of non-descript cattle with exotic semen to keep the exotic inheritance between 50 and 75% is recommended for their optimum productivity.

Immunologists discovered the fact in the 1980s that female herbivores (cattle, buffaloes) undergo lowered immune function twice during parturition; one lowered at drying off due to the endocrine system and a second bigger dip 2 weeks before upto 3 weeks after calvings. Vaccinations and other stress should be avoided around drying off and around freshening but unfortunately these 2 timeframes were unavoidable during this operation and as well are widely adopted by many for vaccinations.

The losses caused to the dairy industry by mastitis are enormous. It is probable that in some herds more than 15% of cows are rejected each year because of mastitis.

Pakistan appears to have a high level of interest in homoeopathy. Last year, the Pakistani Government established homoeopathic dispensaries and medicine colleges that are operational throughout the country (Spranger, 2000).

Homeopathic treatment is a requirement for organic farmers willing to sell milk to the EU; it entails an integrated system of preventive herd health, complementary homeopathic therapy and limited antibiotic use. Savings are made on the cost of therapy using homeopathic treatment and less milk lost because unlike when antibiotics are used no withdrawal period is required (Klocke *et al.,* 2004).

In a nutshell the project shows that smallholder dairy farmer needs the following technical services (Enemark and de Haan, 2007);

1- Animal health/veterinary services, both preventive (vaccinations, tsetse control etc.) and curative (treatment of individual animals for diseases such as wounds, udder infection, mastitis etc.);

2 - Improved breeding services through artificial insemination, or natural

breeding; and

3- Agricultural technology advisory services on feeding, management, milk hygiene, and farm economics.

Conclusion/significance

In the short term, the development of feed resources to raise ruminant livestock productivity both in the lowlands and highland areas of Pakistan should be based on better use of crops and crop residues (maize, wheat, grasses) and improving feed utilization through the treatment of these by-product feeds (with ammonia, urea) and diet supplementation with balanced high energy feeds, (urea/molasses blocks, etc). The underlying strategy here should be based on building on the existing system and introducing simple and practical technologies to suit local conditions.

Predisposing causes of mastitis include the presence of chronically affected carriers in the herd, the use of dirty methods of milking which transfers infectious milk from animal to animal, and faulty milking techniques or machines which may by excessive pulling and suction, cause damage (Raza Syed Hassan, 2004).

Improved stock of animals would render the dairy sector commercially viable. Artificial insemination facilities should be made cheap hence affordable for smallholder farmers (Ali Tanvir).

The Achai breed is better suited to mountainous areas and is much appreciated by beneficiaries; proper sourcing should be taken into consideration as unlike the larger Punjabi breeds these cows are rarely sold on the market in large numbers. The dynamic seasonal multi-species grazing system is a complex and integrated part of the agro-pastoral system where the households try to optimise the total outcome taking into account vegetation phenology, species composition, stocking density and other biotic and abiotic factors, as well as social and cultural factors such as allocation of labor force in relation to seasonal demands, grazing rights, tradition and social relations between households and villages(Hoffman, Abbas *et al*., 1998).

Low productivity in agriculture is a major cause of poverty, food insecurity and poor nutrition in low income developing countries like Pakistan(Ali Muhammad Amjad *et al*., 2007). Support to dairy farming has proved an effective tool for raising income of impoverished rural households and such interventions could be the key for alleviating poverty in rural areas (Ali Tanvir). Biotechnology in livestock production examples being artificial insemination, embryo transfer and vaccine production can also help overcome production constraints.

According to the FAO definition "Sustainability is the management and conservation of the natural resource base and the orientation of technological and institutional change in such a manner as to ensure the attainment and continued satisfaction of human needs for present and future generation. Such sustainable development (in the agriculture, livestock, forestry and fisheries sectors) conserves land, water, plant and animal genetic resources, is environmentally non-degrading, technically appropriate, economically viable and socially acceptable(Timon).

Some examples of future activities that could further enhance sustainability of the dairy activities re-started by ICRC/ GRC in PAK thus far include:

- Booster FMD vaccinations and de-worming campaigns in beneficiary villages through the DAH contracting the Community animal health Workers, voucher systems to build a sustainable drug supply. It is important to link the CAHWS to private vet pharmacies for re-supply,
- Itinerant training of livestock owners for further improved management techniques for the improved breeds,
- Promote women's groups for milk collection, hygiene practises, marketing and processing of milk to spur economic growth in the dairy sector. Relying on subsidized milk, dairy products from locally produced milk have to compete with products from recombined milk at prices that often do not cover the cost price for milk produced locally (FAO, 2005).
- The breeding programme for the cows through natural breeding (bulls) or artificial insemination (AI) needs to be strengthened so that the cows can maintain productivity and as well as allowing the farmers recover faster through getting replacement heifers (female calves) and ploughing oxen (males) for agricultural activities. The most important criteria by which the relevance of a breed improvement programme is determined is farmer acceptability; i.e. do the changes brought about by the programme adequately benefit the farmers, in terms of perceived market benefit, investment risk, support service availability and general family welfare (Timon).
- Coordination between agencies and ex-post transactions with suppliers is necessary to avoid encroachment by other relief agencies seeking to work and do similar work examples being involvement of supplier in provision of goods to different parties at the same time e.g. walnut trees, cows, contracting the same CAHWS trained by ICRC/ GRC.
- Clientisation and trust between contracting Agency and suppliers is essential to ensure that quantity and quality of livestock is supplied according to most of the specifications outlined in this report.

- Making Government and donor supported agricultural research and extension services pro-poor and accessible to farmers is certainly a way forward for dissemination of knowledge and new technologies (Government of Pakistan, 2003).

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