Smallholder Dairy Farmers in the Peruvian Andes Fulfilling the Role of Extension Agents

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Abstract
Dairy farming in the Peruvian Andes is mostly undertaken by smallholder farmers (4-6 cows/family) and of relatively recent development. In fact, over the last 2 decades dairy farming at high altitudes (3,500–4200 masl) has grown rapidly, replacing the camelids and sheep farming that once predominated. Dairying growth has been catalysed by subsides from state and private organizations. It promotes high input systems based on feedlot technology. Compared to sheep and camelids farming, dairying at the Andes does not have yet an inherent local/indigenous knowledge associated to it. High altitude Andean ecosystems pose many constraints for dairy farming (hypoxia and high UV radiation, high variation between day and night temperatures, short rainy season, and hence shortage of feed and water; and not less importantly, accelerated climate change (CC)). Under these conditions, not only are productivity and profitability low, but there are high negative environmental impacts and poor animal welfare. In Peru, institutionalised research and extension (R&E) services are precarious. Research tackling current issues of high-altitude livestock farming is almost inexistent, whereas extension in support of farmers is dispersed, poorly funded, of short duration (a few months), focused on transfer of technology suitable to intensive farming systems, and has a high turnover of staff. A systems approach to address the complexity of Andean livestock farming development is lacking. The initiatives from the institutions promoting farming are directed to remediate recurrent problems (e.g., cold stress) or prioritise high cost, low impact activities (e.g., genetic improvement). Here, we present the successful experience of the New Zealand Peru Dairy Support Project (NZPDSP) to promote the adoption of improved low input pastoral dairying husbandry principles, where trained smallholder farmers play a key role as agents of change.

Introduction
According to INEI (2013), 73% of cattle, 94% of sheep and 100% of camelids are found in the Andes, providing the livelihoods to 1’400,000 smallholder families. INEI (2013) reported that in 2012 there were 5'156,000 cattle, 9'532,200 sheep and 3'685,500 alpacas, representing increases of 15, -21 and 50%, respectively, in relation to those reported for 1994. During the last decade, specialization towards dairying has occurred and most likely the cattle population has increased even further. On the other hand, farming of creole cattle and sheep, and camelids has been neglected and marginalised to the poorest grasslands. Farming of Andean creole and native species has developed for many centuries, whereas farming of specialized dairy cattle is of recent development and subsidised. Dairy farming is attractive to smallholders because it provides them with a continuous income. However, the sustainability of the current system is questionable given that is reliant on high inputs and subsides (NZPDSP 2020). Further, there is no locally developed knowledge on dairying, or a purposely designed sound technical assistance program to support it. So, given this void, smallholders are receptive of knowledge suitable for the intensive feedlot dairy farming systems.

The evident mismatch between the characteristics of the dairy specialized genetics (Brown Swiss) and the prevalent abiotic and biotic conditions in the Andes, and the lack of sound extension programmes are determinant factors for the poor production performance and profitability of dairying (NZPDSP 2020). Furthermore, Andean dairy farming is most likely associated with having one of the highest environmental footprints of global livestock production. Addressing current issues facing Andean dairying requires harmonizing synergies between mitigation and adaptation to CC, productivity, food security, animal welfare and general health (Orchard et al. 2020). Achieving these objectives requires the harnessing of validated husbandry practices and extending this knowledge through mass extension services. A mass extension service is justified by the large number of smallholder farmers dispersed across large areas (Morton and Matthewman 1996). Burneo and Burneo (2014) reported that family farms in Peru had increased by 40% between 1994 and 2012, with consequent land atomization. Here, based on a literature review and experience from the NZPDSP, we propose a mass extension program using leading trained farmers as agents of extension.

Status of the agricultural extension in Peru

Ortiz (2006) and Barrantes-Bravo (2017) have summarised the evolution and status of agricultural extension in Peru. According to these authors, the role of the government in providing agricultural information has been erratic. There was a strong role over the 1950s and 1960s, but since then it has been weak. Around the 1990s, the role of the government was drastically reduced, whereas the role of non-governmental organizations in providing participatory approaches of extension had increased, but not in an organised way. In general, there is not a long-term research and extension (R&E) policy commitment from the state, especially regarding smallholder family agriculture. It is only recently that Peru had established a strategy for a national system of agricultural innovation (SNIA; INIA 2019), whose mission is to promote the modernization and competitiveness of the agricultural sector through the formation of alliances and networks to generate, transfer and adapt knowledge and technology that serve to introduce innovations. The strategy aims to build a coordinated structure of private and public organizations, including regional and local governments, in support of agricultural innovation. Nevertheless, the likelihood of success for SNIA, especially with smallholders is bleak, due to various reasons. First, policies in Peru are bureaucratic and often short lived due to political instability. Second, private institutions are typically profit oriented and hence inaccessible to smallholder farmers (especially under a user pays approach). Third, intervention in the Andes is based on principles developed on industrial agriculture, without respect to the cultural heritage and indigenous knowledge. Fourth, funding is of short-term, it targets components of the system and not the whole. Fifth, lack of education on agribusiness and agricultural extension. Sixth, technology transfer, the predominant form of extension service is deep rooted in the institutions. This sort of extension is unfit to tackle complex system issues.

Regional and local governments have the mandate to support agricultural development in their territories, but the technical staff attached to these institutions have high rotation due to political appointments. Agrorural, an institution from the Peruvian Ministry of Agriculture and Irrigation, has the mission of designing, promoting and managing agricultural development through facilitation of the articulation of public and private investments (Agrorural 2020). Most of Agrorural staff are agronomists and some had been trained on the FAO's 'field schools' (FAO, 2016), conceived as a hands-on group learning process throughout the cropping cycle. Although the relevance of crop-based extension theory to livestock can be argued (Kumar et al 2019; Morton and Wilson, 2000), the process of facilitation is not practiced, instead Agrorural staff are often involved in campaigns of animal health and remediation of emergencies arising from climate variability and CC, hence with little or nil impact on practice change for sustainability. Overall, professionals involved in extension lack system approach.

Farmer to farmer (F2F) extension in support of smallholder dairy farmers in the Andes

The goal of the New Zealand Peru Dairy Support Project (NZPDSP, 2016-2020) was to increase the productivity and incomes of small-scale Andean dairy farmers, through the adoption of improved milk production, handling and processing practices, supported by more effective R&E systems. The design of the project outlined the need for the training of a large group of staff from public institutions and universities as officials of extension, but this objective could not be met because of the lack of commitment from these professionals. Consequently, to reach the large number of farmers dispersed over large areas, the project had to rely on the farmers themselves (NZPDSP 2020). The project trained suitable farmers on aspects of pastoral dairying as well as on extension principles, with a farm system perspective. During the field days run on smallholder pilot farms, farmers with key interpersonal skills were identified, subsequently visited on their farms, individually trained, and mentored until they felt fully confident. Key characteristics of these farmers included: having a young family with a clear will to change, fluency in the local language, dairying as the main activity, family farm strategically located and of easy access, decision making clearly in the family, minimum of literacy to access practice guides, flexibility to participate in extension events, and an ongoing commitment to practice change.

The benefits of the F2F extension approach are well documented from experiences in developing countries (Kiptot and Franzel 2015; Kimaiyo et al 2017), including Peru (Hellin 2012). In the case of the NZPDSP experience, the use of the F2F approach was an unplanned path and reasons supporting the approach include:

- Absence of formal extension programmes or pathways – the lack of institutionalised and smallholder-relevant programs of extension,
- Empathy and understanding – a recognition that farmers knew better than anyone else their business and their farming environment, farmers perceive rapidly the benefits of change in farming, farmers

aware of need of change are keen to learn from other farmers already practicing change and achieving benefits, smallholder farmers are naturally system thinkers (any ill decision imply huge setbacks).

- Language – smallholder farmers in the Andes use their native language (Quechua, Aymara) to communicate effectively among themselves - extension events in the farmers' native language is empowering,
- Trust – smallholder farmers often mistrust professionals that are unfamiliar to them and do not see the purpose of being told recipes,
- Location – farmers as agents of extension are located *in situ* (where the service is needed) and easily accessible, farmer led extension is specific and relevant to the local conditions.
- Approach – farmers have natural skills to train other farmers as agents of extension. Farmers prefer to attend capacity building events in the field rather than in a classroom - farmers as extension agents are facilitators of the process of learning in the field (doing things). Farmers observing other farmers showing/demonstrating what they have already done are fully engaged in the process of learning.

Over the ~30 months of field activities, the NZPDSP conducted 760 extension events (field days, group discussions, farm walks and study tours), with more than 25,000 farmers attending (38% women and 75% Quechua-speakers). More than 430 farmers were trained in 2019, with 25% of these being women and 73% Quechua-speakers. Before Covid19 there were ~4,000 farmers applying improved dairying practices and most of these reporting improved net incomes. It is well recognised (Quaye et al 2017) that despite the overwhelming role of women in livestock farming, often they are overlooked. The NZPDSP facilitated women-only groups in field days and women-only discussion groups. Quechua was preferable used in the extension events, except in the northern Peru.

Concluding remarks

Andean dairying is ill-developed and requires improving productivity, addressing at the same time issues of sustainability and adaptation to climate change. The F2F extension approach proved to be a powerful and cost-effective means of promoting sustainable pastoral dairying. It fills the void left by the lack of institutionalised extension service. Nevertheless, the F2F extension approach to be sustainable requires institutional support and resourcing, and accreditation of the farmers fulfilling the role. Resources for subsidised interventions (genetic improvement, building of cow sheds, vitamins drenching) should be redirected to on farm development of validated animal husbandry practices and mass extension of knowledge and practices by means of F2F extension.

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