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Agricultural developments on the rangelands of the Tibet Autonomous Region in China, with a special emphasis on the role of Tibetan women

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Abstract

Tibetan women play integral roles in agriculture on the rangelands of the high plateau of the Tibet Autonomous Region (TAR) in China. Agricultural development was the focus of ACIAR (Australian Centre for International Agricultural Research) funded projects in Tibet including capturing socioeconomic facets. Two projects that the authors worked on (2009-2012) provided the opportunity to explore firsthand livestock production systems in pastoral and crop-based areas of TAR. This paper aims to offer sociocultural insights, and to highlight the role of women in Tibet as enablers of change. For agricultural developments to proceed with greater success it will be important that women are included in changing practice.

Introduction

The Tibet Autonomous Region (TAR) spans 1.2 million km^2 (Tashi et al 2005). Livestock production is a predominant industry, where production systems (meat, milk and fibre) rely on long-established practices. Rapid changes brought about by increased industrialisation and urbanisation across TAR mean the traditional roles that Tibetan farmers and pastoralists once played are also changing. The Australian Centre for International Agricultural Research (ACIAR) has supported several projects in Tibet (e.g., Tashi et al. 2005; Rose 2011; Heath et al. 2012; Spiegel and Costa 2014) to aid the modernisation of agricultural practices so food and Tibetan livelihoods can be secured and poverty amongst Tibetan communities can be alleviated. A Tibetan researcher, the late Dr Nyima Tashi, was a strong advocate of agricultural developments in TAR, and actively established collaborative partnerships with ACIAR.

The following paper is based on the authors' combined firsthand research experiences during their time (2009 to 2012) working on agricultural development projects in TAR, written through the lens of an animal scientist (Spiegel) and an extension agronomist (Rose). Observational evidence, supported by project findings and literature, have allowed the authors to share their insights on pastoral and crop-based dairy systems in TAR, with a special emphasis on the role that women play in dairy production.

Background

TAR is made up of six prefectures and one municipal city of Lhasa situated at 3,656 m asl. Across the prefectures there are 74 counties, almost 900 townships and over 7,000 villages (Tashi et al. 2005). ACIAR funded research on the mineral nutritional status of Tibetan livestock and integrated crop and dairy systems. The former project identified many mineral insufficiencies and deficiencies (Tashi et al. 2005) and confirmed

some alarmingly low, location-dependant, selenium levels in livestock (Spiegel et al. 2011). Two locations of particular interest included one crop-based township (Duopozhang) and one pastoral county (Jiali).

Selenium deficiency in livestock can result in reproductive disorders, but in humans, debilitating multifactorial diseases can occur, such as cardiomyopathy Keshan disease and osteoarthropathy Kashin-Beck disease. Both diseases are known to China, especially within areas of selenium deficient soil spanning from the northeast of China to the southwest to include parts of TAR (Yang et al. 2010; Yao et al. 2011).

Research efforts focussed on improving the nutritional status of Tibetan livestock involved authors spending extended periods in TAR: 5 months (Spiegel) and 3 to 4 weeks (Rose) each year from 2009 to 2012. Mineral surveys and mineral response trials were conducted across counties and production systems (see Spiegel and Costa 2014), and economic (Waldron et al. 2016) and attitudinal surveys (Rose 2011) conducted in the cropping zone of TAR. For the latter, adaptive research surveys, used to assess farm adoption opportunities and barriers, were conducted orally with farmers in Tibetan to avoid literacy issues and poor understanding of Mandarin. Impressions on the Chinese/Tibetan researchers' attitudes were made during presentations to scientific meetings and general discussions during data gathering.

The focus of this paper is on the two locations of Duopozhang and Jiali, representing respectively a crop-based and a pastoral-based livestock production system in TAR at risk from severe mineral deficiency.

Crop-based livestock system: pathways for agronomic practice change

This zone is characterised by traditional farming of intensive cropping and smallholder livestock production on valley floors (Fig. 1) and lower hill slopes with the average farm size of 0.8 ha (Heath et al. 2012) and altitudes ranging between 3,600 to 4,000 m asl. The township of Duopozhang in Naidong County (Shannan Prefecture) was especially of interest to the minerals project (Spiegel and Costa 2014) owing to the very low mineral selenium levels identified in dairy cattle – lower than any international previously published results – and severely low dietary energy and protein intakes of livestock, as seen by poor body condition. Research efforts were consequently concentrated here (e.g., see Waldron et al. 2016) and attitudinal surveys conducted with farmers in 2011 (see Rose 2011 & 2013).

During the authors' time spent in Duopozhang (starting in 2009), rapid changes were taking place. Investment in the expansion of this township by The Peoples Republic of China (supported by a range of International aid projects) meant roads were being developed, additional livestock (e.g., Boer goats and pigs) and new cattle genetics introduced, access and availability of water to households and for crop irrigation was being improved, Lucerne was being planted, methane digesters to supply energy for heating were being trialled, and extension efforts by local officials were starting. Research efforts by local organisations (TAAAS: Tibetan Academy of Agriculture and Animal Husbandry Sciences and the Tibet Poverty Alleviation Office), and international collaboration (TAAAS and ACIAR) were operating simultaneously for maximum impact and allowing for a test site that, if successful, could be used as a model for other crop-based villages in TAR.

During field research, we observed Tibetan sociocultural attributes, behaviours and traditions that underpinned, and were unique to, the production systems in question.

Firstly, it was apparent that Tibetan households were not only dependent on their livestock, but that their daily work, especially of women, largely involved managing livestock. Animals were kept in close quarters and fed with whatever was available, including household kitchen scraps. The dung from cattle was collected, dried and later used as fuel in the household for warming and cooking. Daily routines of Tibetan women also included feeding, watering and milking their cattle by hand twice daily, managing the calves to restrict suckling, letting cattle out of the house yard to graze available pasture (e.g., on the grazing common or tethered in cropping fields to graze weeds or crop residues), and collecting forage for their cattle (cut and carry practices of woody browse species). Secondly, the milk collected was churned by hand to make butter, the highly valued dairy product used to make Tibetan tea (traditional salty butter tea), with some butter spared for butter lamps

in households for religious reasons. The use of butter as a form of topical cream to treat cracked teats in milking cattle was also disclosed by some of the households.

In terms of production, local dairy cows (as locally bred) are of small stature and low milk production. Traditional feeding includes very limited grazing, feeding of weeds, and in winter the use of straw as arable land is used for human consumption crops. As a result, animals have poor nutritional status, including low energy and protein intakes and restricted water intakes. Improving the mineral nutritional status of their livestock would have the benefit of boosting trace elements (such as selenium) in the human food chain. However, without correcting for under-nutrition, the full benefits of mineral supplementation and production responses would not be seen. Thus, overcoming protein and energy deficiencies in dairy cattle was priority. Adopting a focus on agronomic practices and cropping was required. As such, the attitudinal survey (Rose 2011 & 2013) sought to understand motivations for farming decisions and barriers to adoption of practice change such as practices of growing forage crops, double cropping, and supplementary feeding of stock.

The main motivation for increasing production was for a better life, with buying equipment a distant second. Lack of capital was a barrier to trying new ideas on farm, so opportunities to work off farm were considered important to provide the necessary cash flow. A major contradiction though, is that off farm work creates major labour shortages at peak times like harvest. Heath et al. (2012) discuss that strategies such as double cropping with fodder crops have the potential to increase production yet increase labour pressure at peak times. The survey also revealed a general reluctance of the older generation farmers to encourage succession to their younger generation. Observations of the women surveyed was the women did not identify themselves as the primary decision maker in farming decisions.

Delving into the adoption of improved production techniques, the farmers were willing if the practice was able to be done (e.g., new barley varieties / oats / vetch seed available), the up-front costs were not beyond their cash flow, and that the practice worked on their farms. While most projects supplied the early inputs to avoid the cash flow issues, the authors saw that while strategies such as growing maize were successful in the research phase, farmers said they were unlikely to adopt in the long term due to cost barriers. On the other hand, oats had survived beyond the research phase, as seed sales made it an economic option. Some resistance to lucerne had been overcome by the value of selling forage in the towns. Barriers to freely available water for dairy cows include access to flowing water, and the increased runniness of dung being associated with illness in the livestock and increased difficulty in fuel preparation.

Survey questions showed that little extension was done at their villages. Though farm schools were run, Chinese/Tibetan researchers lamented that farmers had to be paid to attend, and farmers felt that the schools were too hard to get to. While fertiliser and insecticides were widely used, there was little understanding of which ones to use or why they did or did not work, or even what the pests were. Herbicides were not popular as weeds are a fodder source for stock.

Fig. 1 Photo capture. Left and centre images: Tibetan farmer and Tibetan style home in Tibet's cropping area. Images on the right: Tibetan yak herders in pastoral Tibet. Photos courtesy of N. Spiegel.

Pastoral system: settlement and flow-on effects

This zone is characterised by treeless rangeland pasture, inhabited by Tibetan sheep, goats and yak and Tibetan nomads/herders (Fig. 1). Pastoral counties investigated by Spiegel and Costa (2014) included the yak and sheep

production counties of Damxiong (4,200 m asl) and Naqu (4,500 m asl) and the yak production county of Jiali (4,500 m asl). For the latter, very low mineral selenium levels were detected (Spiegel et al. 2011).

The restructuring of TAR into production zones (Tashi et al. 2005) and the settlement of people into townships and villages has allowed for the provision of centralised services throughout TAR such as health care and schools, and the development of new housing. However, the restriction of movement of nomads as a result has led to unwanted consequences, such as the concentrated grazing pressure and increased parasitic infection in livestock grazing contaminated pasture observed by the minerals research project during their investigations, as well as degradation of the rangelands seen across different pastoral areas in TAR. Animal diseases and animal husbandry issues have negative flow-on effects for animal production and each household's ability to maximise food production. Although, having centralised services mean animal husbandry extension can be easily established within a county to service the local villages. The construction of a veterinary branch in Jiali County (Naqu Prefecture) for instance was taking place during the authors' time in TAR and could have an invaluable future role to play in disease control and prevention, stocking rate management and in extension and education. Two prevalent diseases affecting Jiali yak production observed by the minerals project included Warbles (Subcutaneous myiasis; caused by warble fly infestation) and brain parasites (Coenurosis; caused by the intermediate stage of the tapeworm *Taenia multiceps*) (Spiegel and Costa 2014).

Despite the rapid changes and modernisation that has been occurring in TAR, we observed traditional ways of life, such as Tibetan pastoralists still living in summer and winter tents. Pastoralists manage yaks for both milk and meat. Nomadic women churn yak milk into butter, an important part of the traditional diet. Other production includes the making of hard cheese, yogurt, yak blood sausages and dried yak meat. Some modern features observed included motorbikes, mobile phones, solar panels and electric appliances such as kitchen blenders. The collection of yak dung for fuel was still apparent at the time and no alternative heating or power for cooking was observed. The upkeep of a stupa (Buddhist shrine) in the township also meant locals could still openly practice religion and meditation, such as carrying out daily circumambulation (kora).

The practice of caterpillar fungus harvesting was encountered. This fungus (*Ophiocordyceps sinensis*), a unique medicinal fungus, is physically dug out and removed from the rangelands soil for trade. What was apparent through translated conversations was that nomadic households could boost annual earnings through harvesting and trading the highly priced *O. sinensis*. Some family members were carrying out annual spring harvesting and therefore spending extended periods occupied by this seasonal work activity rather than by daily livestock activities. The opposing effects for the household are apparent: good for cash flow, but reduced household capacity to tend to livestock. Wang et al (2018) identified other mixed flow on effects, such as low school attendance rates, possibly due to the lack of perceived benefits from education. In addition, there is concern over the overexploitation of *O. sinensis* contributing to the degradation of alpine and sub-alpine pastures (e.g., Hopping et al. 2018).

From extensive time spent in TAR, we observed pastoral women in contemporary Tibet fostering a strong connection and identity to their culture, including traditional dress worn in their homes, providing traditional hospitality, and conducting daily animal husbandry practices using traditional methods. During the field sampling of livestock, women were always present and playing an active role in sample collection. Dairy related tasks such as milking, yogurt and butter production were predominantly done by women. Women were handling their animals daily and a strong bond between handler and animal was evident. For instance, during jugular blood collections of yaks for mineral sampling, any yak that was not tolerating being restrained was quickly quietened and soothed by the presence and touch of their female herder. Animal handling techniques were also passed down to the next generation, with children exposed to animal husbandry or actively involved, for example decorative bags containing salt were carried by older children to lure yaks.

Discussion

Our observations suggest that Tibetan women play pivotal roles in shing-lay (Tibetan for agriculture) and are well placed as being integral to decision making for dairy production on the rangelands in TAR. Our experience

from household visits and survey, showed most women do not identify themselves as the primary decision maker; but that may indicate women are more inclusive, rather than that men dominate the farming decisions. The trend towards reliance on off farm income, increasing the ratio of women to men managing the land, will only increase the role of women on the land. It is therefore pivotal that extension of agricultural research is tailored for both genders. For instance, participatory action learning for women would ideally focus on how production-related changes can interact with the household. Training at the village would be desirable, as women will be less likely to attend if training takes them away from their daily work and children. For men, the focus might be on production and could include training following adult learning principles, away from the village. Changing the perception of the low value of agriculture, to one of a valued profession, as well as increasing production from subsistence to trading, could help reverse the trend of discouraging the younger generation from farming. Part of this is the training of Tibetan farmers and herders to enable them to make informed decisions on inputs and outputs, rather than the top-down supply of information and inputs. Surveys identified, for instance, farmers applying nitrogen-based fertiliser to lucerne, as that was what they were supplied, and a very low knowledge of pests and diseases of both plants and animals. Research would also benefit from the two-way flow of information.

Other changes in a modernising economy may also have a major impact. For instance, in one village visited, methane digesters supplied energy for heating, making the collecting of dung for fuel redundant, and leading to dung being returned to the fields. In terms of optimising milk and meat production, breeding programs and the adoption of yak crosses and larger framed cattle in TAR (e.g., Holstein local cow crosses) run the risk of many adverse consequences, such as increased dystocia, exacerbation of protein and energy deficits, reduced butter fat content of milk, as well as loss of well-adapted native breeds and ecotypes.

Female Tibetan agricultural researchers also have a role to play to assist and promote agricultural developments, however they appear to experience dislocation from their roots due to extended education in ‘mainland’ China. Despite this, the female researchers assigned to survey work were willing to engage in the extension concept and showed empathy with the farmers. From the authors own observations during their time in Tibet, research was the primary focus and endeavour of many, with extension considered to be an early career job with low status. On a study tour to Australia, Tibetan / Chinese colleagues were amazed to meet highly respected extension specialists. This is a paradigm shift that research aid projects could aim to address.

The attitudinal survey work demonstrated the importance of embedding a strong social and extension component into research and development projects. For instance, the unexpected findings of Tibetan farmers using butter on cracked teats of dairy cattle or using nitrogen fertiliser on legumes offers a segway to exploring different methods for adoption to boost trace elements in the human food chain. For example, improved daily management of dairy cattle/yak udders could simply include an iodine-based (‘Iodophor’) teat dip disinfectant. The udder can absorb the iodine. For the application of fertilisers on crops, the option to use selenium fortified fertilisers on both fodder and cereal crops might be worth exploring to boost selenium levels in both animals and humans (G. Lyons, pers. comm.). All research and extension should, however, consider the risk of unintended negative consequences and remain flexible to alter direction.

The paper explored two different livestock production systems operating in TAR. The opportunity for future work to explore potential linkages and trade options between the two systems deserves research attention. With the potential to test new feeding systems and animal husbandry practices in the cropping zone of Tibet and to test and develop disease control in pastoral areas of Tibet. For example, there could be a natural exchange of knowledge and supply of feed concentrates across counties to bolster developments in agriculture on the Tibetan rangelands. Climate change and reduced isolation also leads to a need for further research as growing seasons lengthen and more pests and diseases emerge, and will change accepted management practices.

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