



Research Article

Capacity Building the Knowledge and Farm Management Skills of China's Smallholder Dairy Farmers

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Article History: Received: August 24, 2016 Revised: October 18, 2016 Accepted: November 08, 2016

ABSTRACT

Although it is not widely publicized, over 25% of the two million dairy farms in China are smallholder dairy farms with less than 20 cows. These cows comprising up to 40% of the national dairy herd, have lower milk yields and milk quality than the bigger farms with 50 or more dairy cows. As well as having limited resources, such farmers suffer from poor knowledge and management skills in dairy production technology. This paper delivers an integrated approach to improving their farm management practices in a newly developed extension program called the Dairy Smallholder Innovative Program. This adult learning program is based on:

- A series of simple “take home” messages (namely the Golden Rules)
- Feedback mechanisms to assess their comprehension (namely Key Performance Indicators)
- “hands on” experiences via practical workshops and demonstrations on model farms
- First hand validation in collaboration with objective measures of changes in farm business performance (via the model farms)
- Facilitated sharing of knowledge (within farmer discussion groups)
- An opportunity to assess on farm changes (improvements) in farm profitability and sustainability through individual monitoring of their own farm business performance

Thus ensuring a more optimistic future for China's SHD farmers

Key words: China, Dairy farming, Small holder, Capacity building

INTRODUCTION

There are solid foundations in the China dairy industry. With growing consumer demand for high quality dairy products, some of the highest milk prices in the world, and low labour costs, it is almost the perfect market for investors. However the dairy industry's long term successful development will depend on the ability to improve the quality of products and raise consumer confidence in domestic processors and their products. In order to develop production and growth in both milk quantity and quality, there is a need to focus on management capabilities such as feeding, disease control, cow comfort and welfare and the practical capability of labour, and to align the industry's economic incentives with the required results. If these conditions can be realized, China will continue developing and moving towards a profitable and sustainable dairy industry.

Milk production has grown by 400 per cent in the past decade, from 8 million tonnes in 2000 to 35 million tonnes in 2013, such that China is now the fourth largest consumer of milk in the world. However, like most Asian countries, China is unable to satisfy its domestic needs for milk and dairy production hence relies heavily on dairy imports to fill the gap. One major constraint limiting China's ability to become self-sufficient is the large number of scattered small holder farms with low per cow milk yields. Of the 14 million dairy stock, which includes the 7 million cows, small scale farmers accounted for 40% of these milking cows in 2013.

China's raw milk price leaped from 46 US cents/kg in early 2008 to 68 US c/kg in Jan 2014. In 2013, average farm milk prices in China were about 30% higher than the average world price, with the key factors underlying this increase being rising livestock feed costs and rapid growth in labour and land costs. Despite the increase in milk price, this led to declining milk production margins.

Cite This Article as: Moran J, 2016. Capacity building the knowledge and farm management skills of China's smallholder dairy farmers. Inter J Agri Biosci, 6(1): 13-17. www.ijagbio.com (©2016 IJAB. All rights reserved)

Due to these declining margins, China's dairy cow herd size fell by about 10% in 2013, which caused China's total milk production to fall by 6%. This was the country's greatest decrease since 1949, even more than the decline caused by the melamine crisis of 2008. Raw milk prices in China also began falling in Feb 2014 and continued for ten consecutive months. This was the result of the high inventory levels of dairy production in China and global over-supply in 2014. Nevertheless, it is expected that China's import of dairy products will continue to increase in the next decade.

The share of production from large scale farms with more than 500 cows is growing rapidly, from 17% of the total milk production in 2008 to 27% in 2011. By 2014, there were over 40 farms in China each with more than 10,000 head of cattle, many of which have been populated with some of the 250,000 dairy heifers imported into the country since 2009.

China will continue to see growth of large scale farms and more efficient processing enterprises that target high productivity. With tighter government regulations, further consolidation among domestic farms and milk collection centres is expected. For example, in 2014, the Chinese government announced plans to reduce the number of domestic milk powder manufacturers and to see 10 large dairy entities take over 70% of the market within five years. The government has also introduced dairy breeding subsidy programs to improve cow yields.

Private land ownership is not allowed by the communist system, forcing dairy farms to develop good relationships with the local government to acquire and sustain land lease contracts. Dairy farms must have a land grant contract, in which they obtain land use rights for certain duration (10-30 years), but not the ownership of the land or any resources under the surface. These contracts are signed with the land administration of the local government and in most cases fees have to be paid prior to the start of the contract.

Dairy production systems in China

In recent years a trend of intensification and standardization has taken place in China, whereby intensive dairy farming systems have emerged in a dairy sector traditionally characterized by small holder dairy (SHD) farms. Over the past few years, three distinct dairy farming systems have evolved in China, namely small holder (or backyard) farms, dairy communities (or cooperatives) and large scale farms.

Small holder farms: The number of these "backyard farms", with herd size generally less than 20 milking cows, decreased by 6.5% between 2011 and 2012, since such systems were less desirable in the Chinese dairy chain following the melamine crisis. These farms are operated and owned by rural households, selling surplus milk for additional income. Their model is based on low input/low output systems with poorer quality and cheaper farm inputs resulting in lower milk outputs (averaging only 10 to 15 kg/cow/day). The dairy cows are usually milked in a nearby milk collection station where farmers pay a fee over the milk yield. These stations are owned by processors or individual investors.

Dairy communities: After the melamine crisis, selling raw milk produced in backyard farms became difficult which, combined with rising production costs in feed and labour, forced many backyard farms to exit the industry. To counteract this development, the government encouraged many of these farmers to unite into cooperatives, or dairy communities, and raise their cattle centrally. This leads to benefits from economies of scale, improved quality control and better negotiation situations with dairy processors. Although the cattle belong to the individual farmer, the sheds, equipment, milking parlour and other facilities belong to the dairy community owner. Milk yields are higher than on the backyard farms, namely 15 to 20 kg/cow/day. Members can also opt to participate in a system where sourcing feed and formulating rations is the responsibility of the community owner. Cattle are milked in the communal milking parlour operated by independent farm workers who then assess the quality of the harvested milk prior to sale. As these farms are just a transition between small holder and large scale dairy farming, they are being phased out over the next decade or so.

Large scale farms: These have larger herds, exceeding 200 dairy cattle, where the cows are bred, grouped and managed according to their ages and lactation status. As herd management is more related to breeding and feeding goals, and to improve disease control and farm design, milk yields and quality are superior to those from SHD farms and dairy communities, ranging from 20 to 30 kg/cow/day. The discrepancy between cow performance and herd size is apparent from Table 1 which presents data on yields, composition and quality of milk from large and small Chinese herds in 2008 and 2012.

Cows from the larger herds produced 4 to 5 more kg milk/cow/day, had a higher levels of milk fat and protein (in 2012) and lower somatic cell counts (a measure of mastitis). Positively, higher milk quality is associated with improved animal welfare, milk yields and therefore herd profitability. In coming years, milk quality will continue to be the focus of the industry, alongside production.

Constraints to dairy farming in China

From his survey of 26 dairy industry stakeholders, Van de Ven (2014) provided a list of the key constraints to the development of China's dairy industry in future years. In decreasing order of priority, they were:

- Shortage of land for forage production
- Underdeveloped dairy market (that lack of diversity in locally produced dairy products)
- Poor competitiveness on world markets
- Poor manure disposal solutions
- Poor farm management skills
- High cost of processed dairy products
- Low farmer returns for raw milk
- Lack of long term planning by dairy processors
- Shortages of water for farm use
- Departure of many SHD farmers
- Weak investment climate for future developments
- Farmers inability to innovate
- Growing awareness of environmental pollution
- Local consumer distrust of locally produced dairy products
- High cost of milk production

Table 1: Typical yields and quality of milk from small and large dairy herds in China in 2008 and 2012

Herd size	Milk yield (kg/cow/day)		Protein & fat content (%)		Somatic cell count (thousand/ml)	
Year	2008	2012	2008	2012	2008	2012
1 to 50 cows	19.1	19.0	7.3	6.9	710	468
1000 + cows	23.7	25.7	7.0	7.1	509	345

One interviewee considered that Chinese dairy farmers lacked the ability to invent, develop and commercialise new technologies within a context of Chinese dairy farming limitations, so clearly there is a real need for capacity building programs in dairy production technology. Another interviewee stressed that dairy processors only had short-term perspectives, which is reflected by them purchasing milk powders internationally instead of preferring domestically produced raw milk.

Chinese dairy farming practices are relatively underdeveloped and stem from imported dairy farming practices. Further research is needed to better understand how these dairy farming practices should be optimised to suit Chinese conditions. Van de Ven (2014) suggested some research objectives, such as:

- How to increase the yields and quality of Chinese forages to achieve economies of scale?
- How to formulate low-cost optimal dairy rations with domestically available feed inputs?
- What dairy breeds, and with which breeding values, are the most suitable for the Chinese climate and available feed inputs?
- How to improve farm management practices with the focus on improving longevity and sustainability of the dairy herd?
- What is the optimal Chinese dairy herd size, based on cost management, environmental impact and food safety?

A bundle of eight resources were identified as responsible for the competitive advantage of large scale over SHD farms. These were feed procurement systems, genetics, technology and machinery, natural resources, human resources, financial resources and organisational skills.

In conclusion, Chinese dairy farming development will evolve driven by consumer demand and directed by governmental policy. The main question is what does China want to accomplish? Is it a competitive dairy farming sector to decrease dependency on imports, to overcome limitations to large scale dairy farming, to prevent resource degradation or is it to continue the policy trend towards higher food safety to regain consumers' trust?

Capacity building the farm management skills of China's SHD industry

With the decline in the size of the small holder dairy industry in China, farmer support would be a lower priority than on the ever increasing number and size of large scale dairy farms. The large numbers of these SHD farms (500,000) and the benefits they generate through daily income generation via milk sales means that certain geographical regions will always have a SHD industry. Therefore it is important to identify these regions then provide them with relevant capacity building programs to improve their farm management skills hence their profit abilities and long term viabilities.

Moran and Chamberlain (2016) have developed a dairy extension program specifically for SHD farmers throughout Asia which is called the Dairy Smallholder Innovative Program (DSIP). Its major objective is to improve individual farmer skills primarily in dairy production technology to improve the productivity of their milking herds to stimulate their farm performance, profitability hence long term sustainability.

The DSIP incorporates five closely related strategies, namely:

1. Crystallising the major farm activities into a series of "Golden Rules"
2. Quantifying the beneficial impacts of adopting these Golden Rules using Key Performance Indicators
3. Demonstrating them on a series of model farms which is more likely to encourage farmers to adopt them than by other capacity building approaches such as class room type seminars
4. Disseminating the benefits of improved farm management practices to a large numbers of small holder dairy farmers through a series of structured discussion groups
5. Providing each participating farmer with the opportunity to more closely monitor his/her own farm productivity and economic performance using a Farm Business Management approach

The golden rules

These crystallise farm management practices into eight "Golden Rules" that cover the entire range of on-farm herd management practices, such as:

- Calf rearing
- Rearing weaned heifers
- Feeding milking cows
- Breeding adult cows
- Looking after the herd's animal health
- Heat stress management
- Housing dairy cows
- Producing quality milk

For each Golden Rule, we have developed a glossy brochure (which includes simple drawings) that highlight 7 or 8 Best Management Practices (BMP) to provide a simple set of "take home messages" which could easily be translated into the Chinese language. Forage production was not included as one of the Golden Rules because of the diversity of soil and climatic variables throughout Asia and the wide variation in BMP's that can produce quality forages. In addition to developing these Golden Rules, Moran *et al* (2016) has prioritised the necessary improvements to many of the current traditional dairy herd management practices on Asian small holder dairy farms.

Key performance indicators

The concept of Key Performance Indicators (KPI) is not new. However it is when applied to quantifying the performance of SHD farmers in Asia (Moran, 2009).

Expressed simply, KPIs are diagnostic tools allowing farmers to improve their farm productivity hence their financial performance. Farmers can use them to identify weaknesses in as well as set specific targets for their farms. They are more likely to try to improve their systems if they know by how much they are less productive compared to others.

Each KPI provides a valuable insight into the farm resources and management skills of individual small-holders. However it is important to priorities them based on;

- Their relevance to the farmer's current stage of farm development
- The farmer's ability to interpret the data and use it in future decision making
- The ease and accuracy of collecting the necessary raw data.

Although many Asian dairy farmers intuitively think about farm costs and returns, greater use could be made of formats allowing them to be more aware of the relative importance of all their financial inputs in terms of cost of production (COP) per kg of milk produced on the farm.

Knowing their cost of production allows them to determine their profit margins and this is critical to operating a sustainable dairy enterprise. Farmers must do more and better planning if they are to achieve greater profits Profits are not something they end up with at the end of the year. Rather, they are something for which farmers must plan.

It must be stressed that no single KPI should be used in isolation to assess farm performance and hence profitability, as each one is the end result of interactions between many farm inputs. It is important to ensure there is a balance between their utilisation so that one production target is not achieved at the expense of others within the farming system.

Model farms

Farmers are experiential learners in that they learn more by doing something themselves (and being able to monitor its impact) rather than by the more traditional learning programs of class room tuition and short "hands on" practical sessions. However, class room sessions are important because they provide the opportunity to explain the theories behind such practices, which are an integral component of any learning process. Better comprehension of "why things happen" will improve the understanding of "how to make things happen", because all too frequently "things do not go according to plan" because of various unknown and/or unexpected consequences of farmers' actions.

Since farmers learn more by watching and then doing, they need to be provided with every opportunity to watch. This can be provided on the farms of collaborating farmers, or better still, on a model farm. The latter is more desirable because there is more control over farm activities and it is easier to monitor the impacts of changes in farm practices. Using selected farmers who agree to allow their farms to be more closely monitored will provide a control situation so farmers can more easily see and understand the impact of any direct changes in herd performance and farm profitability as a result of such improved management practices.

Model farms should then be established to provide farmers and service providers with an overview of the cause and effect of modifications in farm practices. This is ideally suited to demonstrate the impacts of improved animal welfare. For example, the many benefits rising from the construction of a more "cow friendly" shed (Moran *et al.*, 2016) can be demonstrated by comparing herd performance with that of an existing more traditional shed construction. As SHD farmers in many countries routinely travel twice each day to deliver their milk to milk collection centres, establishing a model farm in close proximity to the collection centre, should encourage them to frequently visit it to monitor progress in any demonstration trial. Offering regular field days, at which the latest results are discussed, would further help in their dissemination.

Discussion groups

As already mentioned, farmers are motivated to improve their management practices more by seeing than by reading or attending training programs. They are also not good at keeping records unless they are sufficiently motivated.

Already successful in most developed dairy industries, for some reason discussion groups have rarely been effectively utilised in Asia. Granted there are a set of ground rules for any successful discussion group, but these should not be too onerous for the concept to become more fully accepted in Asia.

Farmers generally like gathering together to share ideas

- This is even better if they can visit a farm and see how the management is and learn from what the farmer does well
- The model farm is an ideal venue for such a visit
- Groups can encourage innovation and new ideas as people are more creative in groups
- Groups allow ideas to be more effectively communicated and applied.
- Groups can enhance networking and learning through pooling of skills and knowledge from individuals
- Such groups must have strong aims or direction and clear objectives and aims must meet people's needs.
- These objectives need to be regularly assessed to see if they still meet people's needs and expectations.
- The group should collectively plan the program for the next few months

In summary, discussion groups are most successful if:

- They are well organised and have a planned approach
- They have well planned activities with a clear sense of purpose
- There is strong "ownership" of the group's direction by the farmer members
- Groups are effectively facilitated
- Information and planning is driven by regular evaluation of the group and its achievements
- The facilitator and host farmer have a good idea of the key drivers to success of the business and knowledge of its potential barriers to success.
- The host farmer is always comfortable with what is being presented to the group
- The session concludes with a summary of the discussion and any opinions or thoughts that have

been raised, to allow the group to clarify points of discussion and see that the discussion is targeted towards improvement

- The group members can develop a good insight into what the model farmer is doing particularly well so they can take home potential “successes” to apply to their own farm business.

Assessing farm business management

It is possible with a series of specific targeted questions to be easily able to quantify the cash flow, cost of milk production and business performance on any SHD farm. Such an exercise on each DSIP participating farm will provide individual base line data from which to predict the likely financial benefits in achieving target KPIs. More importantly, it will also provide comparative data on the changes in farm performance of model farmers.

We have developed a series of observations that can easily be made when visiting any dairy farm to assess the current management practices, the performance and welfare of the stock and the likely profitability of that farm. These questions, (summarised by Moran and Chamberlain, 2016) cover a range of aspects of farm and business management in the following areas:

- Shed and facilities
- Stock
- Feed supplies
- Answers to simple questions such as how many cows did you milk yesterday, how much milk did you sell yesterday and for what unit milk price?
- Answers to more complex questions such as do you keep any farm records (if so, which ones), what are your typical number of days between calving to conception, do you have any animal health management and biosecurity plans in place (if so, describe them)?
- The final question is “Name three of your biggest problems on your farm”. This can be any constraint at all, such as labour supplies, government/coop or milk processor support and services, dry season forage supplies.

Conclusions

Many of the SHD industries throughout Asia (including China) have been hampered by the low relative performance (milk production and herd fertility) of their dairy stock, particularly in recent years. Much of this is due to the poor management skills of the farmers to improve their levels of dairy production technology. The DSIP has been specifically developed to provide these farmers with an adult learning program based on:

- a series of simple “take home” messages
- feedback mechanisms to assess their comprehension
- “hands on” experiences via practical workshops and demonstrations on model farms
- first hand validation in collaboration with objective measures of changes in farm business performance (via the model farms)
- facilitated sharing of knowledge (within farmer discussion groups)
- an opportunity to assess on farm changes (improvements) in farm profitability and sustainability through individual monitoring of their own farm business performance

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