Analysis of Water Footprint (WF) in Bangladesh Dairy Farms: an Implication of Food Security

Sultana, M.N., Uddin, M.M., Ndambi, O.A. and Hemme, T.
IFCN Dairy Research Center, Schauenburger Straße 116, 24118 Kiel, Germany
nadira.sultana@ifcndairy.org

For a Better Understanding of Milk Production World-Wide

Introduction

Bangladesh (BD) has been facing water crisis that affects development (e.g. Dhaka is the mega city of 12.5 million people and has to rely 90% ground water). Rice is the basic to food security and economic development. On the other hand, rice straw contributes > 90% dry matter in a typical ration of dairy cattle. BD is popularly known as water abundant country but it has also most productive dry season. Recently, water scarcity is further aggravating due to climate change, population and economic growth and expected it will be a major limitation to future food production.

There is projection that only 78% of current water will be available in 2030 in Bangladesh, when there is a widely held view that global food production will have to increase by 50% over current levels by that time to meet increased population demands. So this is a most important issue for Bangladesh and the first step to tackle the situation is to measure water footprint (WF) for food production.

Methodology

This study aims at developing a method on key factors for instance: a) water use (WU) as irrigation and rain-fed for home-grown (HG) feed and virtual water (VW) content of feed brought-in, b) drinking and c) service water used in the farm. An extended version of the **TIPI-CAL** (Technology Impact Policy Impact Calculations model) of International Farm Comparison Network **(IFCN)** was used for this analysis. The underlying farm data set for this study are the average and large-scale typical farms in BD.

Data collection from typical farms

Steps	How
1. Identify and clustering the most eminent dairy regions	Based on local/national statistical database, Transect and Spatial Map Distribution study (criteria: the most common farm type within the production systems or regions and consider average management)
2. Selection of typical farms 3. Data collection and validation	By panel approach (this included farmers, local and national dairy expert, technical adviser, external dairy researcher)
4. Compute virtual typical farm	At IFCN and further validation done by researches at IFCN and during dairy conference
5. Analysis on water footprint	Used co-efficient and input data collected on typical farms and finally analysed by an extended version of TIPI-CAL

To calculate VW consumed from purchased feed, the co-efficient was used as VW trade concept as farmers import feed from interregional and outside of the country. The statistical methods were employed to quantify rain-fed and irrigation WU to grow home-grown (HG) concentrate and roughage. In BD, most of the feed and fodder is used by-product of cereal crops (e.g. rice straw) as input for milk production. Total water applied is allocated between main and by-product in proportion to the revenue generated from them.

Farm description

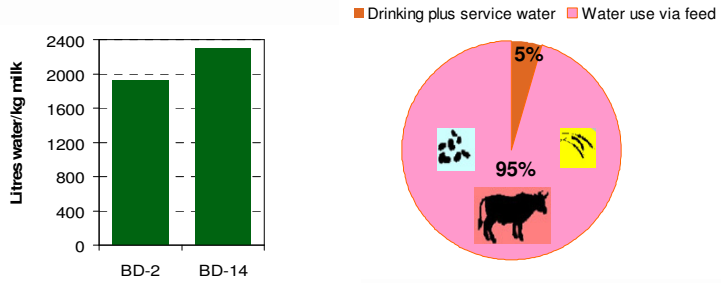
Variable	BD-2 (average - scale)	BD-14 (large –scale)
Breeds	Local	Local*Shahiwal or Frisian
Milk yield (kg/cow(year)	700	900
Age at first calving (Months)	42	36
Total Land (ha)	0.5	2.5
Stocking rate/ha of land	9.63	12.76

Results and discussions

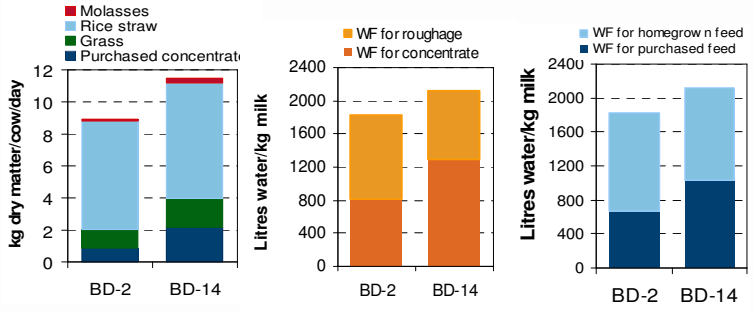
The upper left figure shows the total WF (l water/kg ECM) of 1924 and 2297 for BD-2 and BD-14, respectively.. The typical ration used by the BD dairy farms are straight forward with high amount of roughage that mainly rice straw with little amount of concentrates (middle left figure). Although the amount of concentrate is used low but water used is higher than roughage because to grow cereals need more water. The water used for HG accounts substantially higher (60%) than the water used from purchased feeds (35%) for BD-2 but the water used from purchased feed is higher for BD-14 farms (45%) as this farm has to rely more on purchased concentrates (figure middle left). The lower figures shows irrigation water and imported VW play a major rule and there is competition for water consumption between dairying and human being.

Result charts

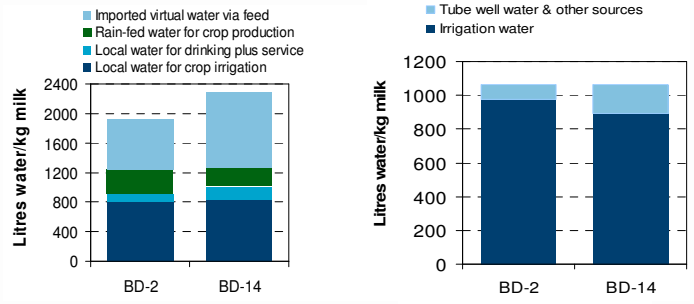
WF analysis per kg milk and it drivers



Ration and detail analysis of WF from feed



Water Source and amount of water usable for human consumption



Conclusion

The key findings from this study are that to produce one kg of milk in Bangladesh need

- Approximately 2000 liters water and > 95% water is used via feeds
- Only 5% water used through others (e.g. drinking, service etc).
- Share of irrigation water is really big (45%)
- 1000 liters /kg milk that can use for human consumption.
- Finally, intensive farming (BD-14) needs more WF/kg of milk as they rear higher number of animal but productivity per animal not really higher than small typical farm.

Outlook: Analysis from preliminary version. By the time we developed LCA-based water footprint model. Validation still in process!