Measuring water footprints in dairy production worldwide in a climate change scenarios

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

Pressure on water resource has been increasing in recent years as a result of climate change, population growth, economic development, and demand driven by industry in general and agricultural sector, in particular. The agricultural sector consumes about 70% of today's global fresh water. While livestock production impacts heavily on world's water supply, accounting for more than 8% of global human water use and 29% of agricultural water use. Moreover, the decreasing trend of water availability is a risk to livestock sector and thus increasing the problem of food security.

As world population is going to increasing by about 67% in 2050 which will lead to the need of double amount of dairy products and therefore, 100% more water will be needed than now. So to secure batter future water management, there is necessary to develop systematic approach to quantify actual water used for food production.

Methodology

This study aims at developing a method for calculating water footprints for kg milk production. 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 typical farms of the IFCN. The method was tested on 12 typical dairy farms from six developed countries: Canada, Germany, New Zealand, Spain, Switzerland and USA and six developing countries: Argentina, Bangladesh, China, Czech Republic, Jordan, and Pakistan.

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

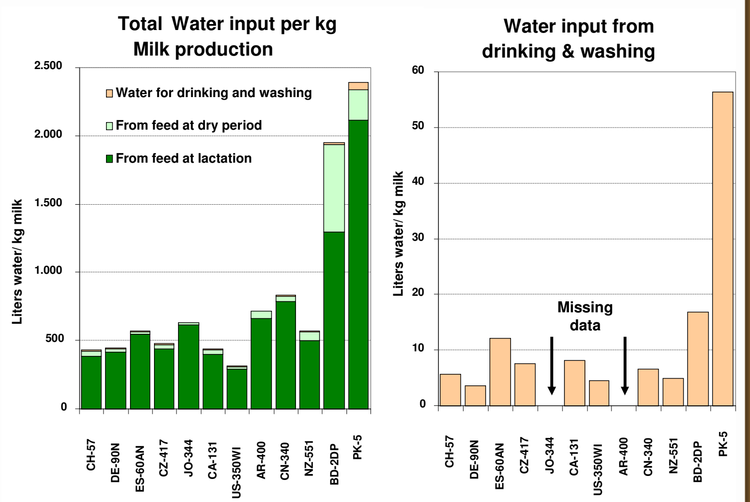
Description of the farms selected

Farm Code	No. Cows	Breeds	Milk yield (kg/cow/year)	Land (Ha/farm)	Labor used (hrs/year)*
CH-57	57	Brown swiss	6800	46	6570
DE-90N	90	HF	8500	95	5250
ES-60AN	60	Holstein	9344	90	2900
CZ-417	417	Fleckvieh	7350	1537	1920
JO-344	344	Holestein-Fresian	7500	9	8490
CA-131	131	Holstein Friesian	8699	249	7510
JS-350W	350	Holstein Friesian	11104	280	14250
AR-400	400	Holstein Friesian	5986	485	3848
CN-340	340	Holstein	5000	0	9905
NZ-551	551	Crossbred	4511	259	5250
BD-2DP	2	Local	700	1	900
PK-5	5	Nili Ravi	1850	2	6205

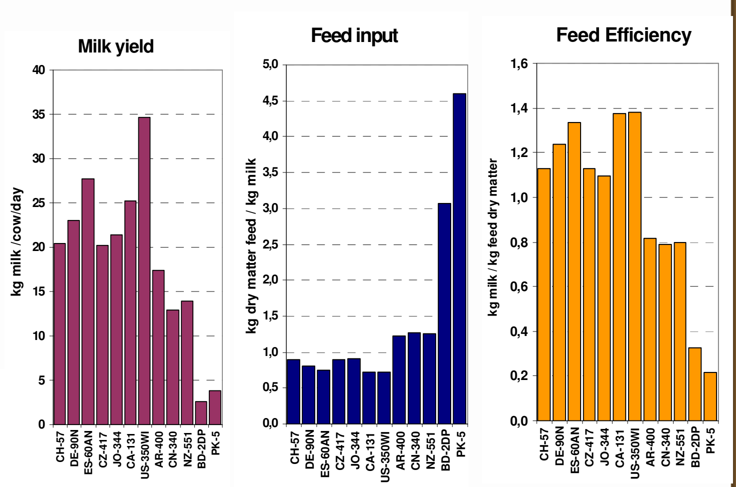
Results and discussions

The results show that cows have their highest water requirement during lactation period which varied from 66% of their total requirement in Bangladesh to 97% in Jordan. Water use during dry period was highest in Bangladesh (33%) due to very long dry period. The water footprint per kg milk varies from 430 liters in USA to 2400 liters in Pakistan due to variability in milk yield and management system. The water used for drinking and servicing ranged between 3.5 and 56.0 liters for Germany and Pakistan (high temperatue), respectively. The most important drivers are water use for feed prodution and feed efficiency. The US-350WI which used least amount of water, had feed intensity of 720 gm and feed efficiency of 1.38. The opposite was observed for Pk-5 (feed intensity 4.59 kg and feed efficiency of 0.22).

Result charts



Drivers of water footprints



Conclusion

- Results of water footprint showed marked variations between the farming systems.
- The measuring of water footprints in dairying is a step towards achieving efficient water use which will augment food security and enhance climate change adaptability

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

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