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## Economic and Water Footprint Evaluation Based on Intensity of Production for Dairy Farms in Bangladesh: Implications for Food Security

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### Abstract

Milk production in Bangladesh falls under pressure as a result of rising demand and simultaneously it has faced challenges to cope with high input and low output prices. Apart from this, water scarcity is an increasing problem which affects the environment, society and dairy production. Dairy farming needs to consider more efficiently both costs and water use (WU), therefore, the objective of this study was to assess the costs and water footprint (WF) of one kg energy corrected milk (ECM) on six typical case farms representing three different production systems with varying intensity. Further, a scenario analysis was carried out in order to identify potential ways to reduce costs and WF. The economic analysis was done by applying the TIPI-CAL 5.2 model. The WU impact assessment was assessed by Life Cycle Assessment-based WF method.

The average cost of milk production ranged from 0.23 to 0.33 USD kg<sup>-1</sup> ECM. The higher the production intensity, the lower the costs per kg ECM were observed. The lower costs were due to lower opportunity costs of own factors of production and very limited fixed costs per kg milk. The feed cost had the highest contribution (an average 0.18 which accounts for 67% of average costs 0.27 USD kg<sup>-1</sup> ECM) to the total costs. The opposite results were observed when analysing the WF, the higher the intensity of production, the higher the WF kg<sup>-1</sup> ECM. The single stand-alone WF (L H<sub>2</sub>O e kg<sup>-1</sup> ECM), integrating consumptive and degradative WU impacts, ranged from 11 to 45. The determinants for lower costs were the increased milk yield, feed efficiency, labour-land productivity, irrigation and purchased compound feed. A larger WF was due to a higher water stress index, purchased feed and irrigation. The scenario analysis showed that there was a potential tradeoff between economy of production and reduction of WF. However, results suggest that altering farming system towards high yielding cows and on-farm feed production in regions with lower water scarcity index might be an option to reduce costs and burden on water systems for sustainable dairy farming, thereby keeping the competitive advantages of the dairy industry and increasing food production for ensuring food security.

**Keywords:** Bangladesh, food security