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On-Field Assessment of an Innovative Solar Powered Milk Cooling System in Tunisia

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Abstract

Farmers in rural areas often lack on-farm storage and cooling possibilities which affects negatively the quality of their products. In the case of raw milk, a rapid cooling within the first two hours after milking is necessary for its preservation. In warm regions where milk cannot be cooled down, the risk of the milk rejection increases causing economical losses to farmers and milk collectors.

The University of Hohenheim in Germany has developed a solar milk cooling system. The technology is based on the use of 40 liters' conventional milk cans with a special designed ice compartment and removable insulation. The ice is produced by a solar powered freezer able to adapt to solar radiation with the help of an adaptive control unit. The concept allows cooling down up to 60 liters of milk by using ice as cooling medium.

In order to test the innovative system on the field, 10 milk cooling units were installed in 7 small farms in two regions in Sidi Bouzid, Tunisia.

Thermal milk cooling behaviour and transport times were tracked. Moreover, the milk quality of both cooled and uncooled milk was tested for morning milk at its arrival to the collecting centre. Furthermore, the possibility of using the system for overnight storage of evening milk was likewise assessed.

The results obtained from the different experiments showed that the temperature of the milk in the insulated cans decreased from an initial temperature of 35°C to less than 15°C in the first two hours. For the overnight storage, the milk was delivered to the collecting centre with a temperature of 8°C. The cooled milk had a higher quality compared to the uncooled milk which presented a bacteria growth of up to 4 times higher than the cooled sample. Milk stored overnight with the presented system was accepted by milk collecting centres opening for new business models for farms where milk is only picked up once a day. The results showed the capability of the system to enable farmers to access to small-scale refrigeration and increase their income while positively contributing to rural sustainability.

Keywords: Assessment, dairy farm, innovation, milk quality, on-farm cooling, solar energy