BADDIBU PROJECT

Report of alternative cooling systems in the Gambia

Simon Kostelecky, Maximilian Kraft und Jonas Wilke

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1. Introduction

After our three months preparation phase in Stuttgart, Germany, we worked in Farafenni, Gambia in the Rural Development Organisation (RDO), which is the Gambian part of the Sabab Lou foundation for three months.

This work summarises our work in the four villages in which the RDO is doing development work. From our leadership it was decided to concentrate on the cooling systems, so we didn't build any drying machines. Therefore our report focuses on the clay brick cooling systems.

In the beginning we describe our motivation and goals building cooling systems. Then we describe briefly how we built the systems one by one and how we improved from one system to the other by the gained experience. While building the systems, we recognised that we want to write a manual for the construction of a cooling system for the villagers and other organisations. The whole manual is the next part of this report. Ending that chapter is a short description of the workshops we held in each village.

The third part is concentrating on the analysis and evaluation of our results testing the cooling system. As we measured the temperature outside and inside of the cooling systems, we gathered information about the functionality of the systems.

In the fourth and last part we describe how we see the future of the project. There is a summary about the situation in the project in Farafenni, Gambia and the RDO. This chapter is intended for following students working for the RDO to help them settle in. They find information about transportation, the social structures in the villages and important contacts in the RDO and the villages.

2. Clay brick cooling systems

This is the main chapter of this report as it was our big objective to build cooling systems.

2.1 Motivation and goals for implementing the cooling systems

Our highest goal is to make the cooling systems sustainable. Therefore they must have following features:

- Payable price for a group of women through microcredit program or cash

- Good functionality

- Easy to build up and maintain (villagers should be able to do construction and maintenance of the cooling systems themselves)

- Usage of locally available materials only

- Long durability

We believe that if any of these criteria is not fulfilled by the cooling system, it cannot be sustainable. Additionally, in the workshop which is described in chapter 2.4 in detail, we showed the villagers and especially the technical committees how to construct and maintain the system and answer open questions. Maybe they can even take it as a business opportunity and build cooling systems in other villages as well. All that will hopefully make up to a sustainable storage solution for the villages. At the moment, it is obviously not possible to say whether the system is durable or not. We can only say that houses built in a similar way with the same materials are very durable.

2.2 Cooling system

2.2.1 Different cooling system options

The cooling systems of this internship are based on the principal of evaporative cooling. For the functionality of these cooling systems is no electricity necessary. There are several types of evaporative cooling systems, which are built up in countries of the global south [1].

Figure 1 shows a cooling system, which was built during the internship. We decided to build up a single-walled cooling system. The idea was to safe costs by not building a second brick wall and spent these saved costs for an automatic drip irrigation system. The height of the cooling system is more or less determined to around 0.80 m, because as the cooling system has no door, one has to bend over the top to reach the goods in the system. Also the width of the cooling system is restricted to approximately 1 to 1.2 m (cf. [1]). The length is variable. The drip irrigation system consists of one water bucket with a capacity of 100 litres, a water tap and a water hose or a plastic tube. In this water hose small holes are

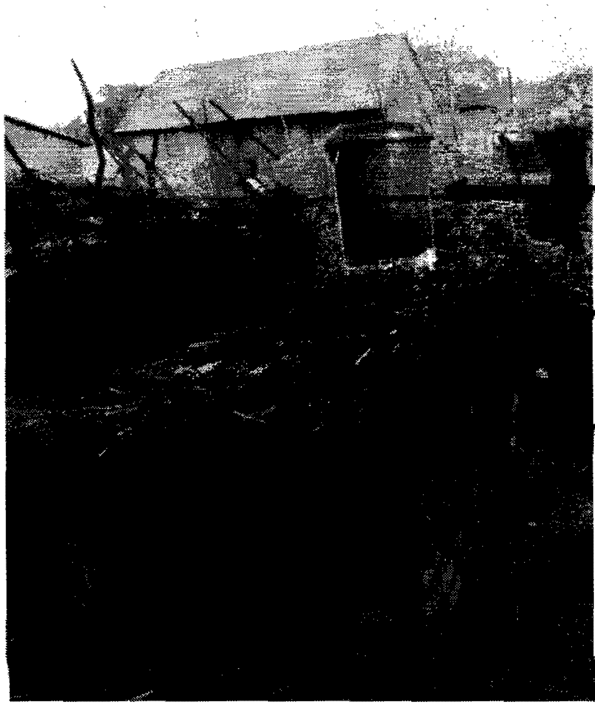

Figure 1: Clay brick cooling system with automatic drip irrigation system. The water bucket in the back is connected with a hose pipe, which is fixed to the outer wall of the system. The roof is made out of straw and wooden sticks.

stung in. These small holes enable the drip irrigation. The water hose is fixed with wire or rope to the outer wall of the cooling system. Due to the static water pressure in the bucket, the water hose is filled. The brick wall is now watered outside during the day by this irrigation system. The clay bricks, which are used in the cooling system of Figure 1, are burned ones. The burned clay bricks have the big advantage that they can store water much better than sun-dried clay bricks.

In general it is possible to build the cooling system with both the sun-dried clay bricks and the burned ones.

Table 1 shows the water storability of burned and sun-dried clay bricks in comparison. The burned clay bricks are obviously able to store the double amount of water than the sun-dried clay bricks. The more water one brick can store the better for the cooling system. This is because of the fact that water needs to evaporate on the outer wall to extract heat from the interior of the cooling system.

Table 1: Comparison of the amount of stored water between one sun-dried and one burned clay brick. As one can see the burned clay brick is able to store nearly double the amount of water than the sun-dried brick[1].

	Sun-dried clay brick	Burned clay brick
Stored water [l/m³]	190	360

[1] The storage of water was measured with a bin full of water. The water level in this bin was read both before the brick was put inside and after it was fetched out of the bin.

Figure 2 shows a schematic exposure of both a single-walled and a double-walled cooling system from above view. Due to the sustainable goal of this internship, it is necessary to build up the cooling systems in the easiest way with the lowest costs. To compare the prices, this report sets four different scenarios. Initially it is possible to build the cooling system mentioned in this report with or without an automatic drip irrigation system. The automatic drip irrigation comes always along with the single-walled model, which is shown in Figure 2 a). If the cooling system is built up without drip irrigation the double-walled model of Figure 2 b) is necessary [1]. Besides the irrigation system it is possible to build up the cooling system with either the sun-dried or the burned bricks. So one comes to the following four different scenarios:

a. single-walled with burned bricks + drip irrigation
b. single-walled with sun-dried bricks + drip irrigation
c. double-walled with burned bricks
d. double walled with sun-dried bricks

To make the four scenarios comparable it is necessary to determine the size of the cooling system. The size namely defines the amount of bricks for one cooling system. Therefore this report assumes the size of the cooling system to 2 m length, 1 m width and 0.80 m height. For this size around 250 bricks are necessary. At which one brick has the measurements of 0.20 m length, 0.10 m width and 0.10 m height. The burned bricks have to be bought at the local market for six Dalasis per brick. The sun-dried bricks are locally made and consequently free of charge. Only the cement, which is one component of the sun-dried bricks besides clay and water, has to be paid. One cement bag contains 50 kg and costs 200 Dalasis. Besides, one has to calculate another amount of cement bags for laying the bricks with plaster. The amount of cement for it obviously depends on the way of laying bricks and is different from operator to operator. Therefore we assume one bag of cement for a single-walled cooling system, which makes it nearly two bags of cement for a double-walled cooling system of the same size.