49. ilongero

A Drip Irrigation System using recycled materials

Jafari Ndagula and Fidel Samwel

Introduction:
Farming in semi-arid regions is difficult due to limited water quantity, and inefficient use of water results in quick evaporation in this climate. As young scientists, we have come up with a solution for how people can increase crop yield while conserving water with drip irrigation. Drip irrigation is a method that releases water *slowly* and directly to a plant's root system over an extended period of time. This helps plants to grow well, resulting in good yield. It also helps to reduce required working hours and labour, increases tolerance to atmospheric conditions like wind and strong sun, and reduces ill-effects of irregular watering [1].
Apart from the agricultural advantages of using drip irrigation, this method makes use of common waste products such as plastic water bottles. This can play a part in environmental conservation.

Methods:
Experimental Site
The study was conducted at Ilongero village in Singida, Tanzania. The site was in a low-lying area with nearby access to water for irrigation. The soil texture was sandy with a neutral pH (data from students not published), and the experiment was started in the middle of the dry season, when no rainfall was expected.
Preparation of Land and Garden Layout
The total area of land used was divided into two equal areas to allow preparation of control (C) irrigated plots, which means pouring water directly on the soil surface surrounding a plant, and drip-irrigated (DI) plots that use our device for water delivery to the roots. Comparing results from C and DI plants allows the effectiveness of the device to be observed. Each plot was prepared in a similar manner as follows: In accordance with local procedures for garden preparation, soil was first softened with a small amount of water, and then dug to a depth of approximately 15cm for the entire area of each garden bed after first clearing the area of grasses and plants. The soil was again dug the next day to obtain a uniform and workable soil consistency. Each maize plot was 396cm x 355cm with four rows of eight plants for a total of 32 C maize plants, and 32 DI maize plants. Spacing between rows of maize was 60cm, and between plants was 45cm. Each Chinese plot was 220cm x 340cm with four rows of 16 plants for a total of 64 C Chinese plants, and 64 DI Chinese plants. Spacing between rows of Chinese was 46cm, and between plants was 20cm. A diagram with measurements is available at request.
Construction of Drip Irrigation System:
The drip irrigation system was constructed entirely from materials found in the village of Ilongero, or with supplies found inSingida town (approximately 25km distance). As shown in **figure 1**, for each type of crop planted a tap in a 60L bucket was used to supply water to ½" PVC lines that ran the entire length of each row of crops. Each pipe supplied water to inverted 1.5L plastic water bottles, and then to smaller-gauge syringe tubing as in **figure 2**. At the tips, flattened and dulled syringe needles were used to control water flow, and covered to prevent blockage. These parts worked cooperatively to ensure efficient supply of water to the plants. First, the bucket is filled with water and the tap is opened. Water flows through the pipes to fill each bottle fixed under a hole. The syringe tubes and needles deliver water drop-by-drop, allowing water to stay at the root of each individual plant while preventing excess evaporation.
Sowing of Crop and Application of Water
As stated above, 25 days after planting Chinese plants, they were transferred to the larger garden. Three maize seeds were planted to ensure germination of at least one, and after 14 days, two of the three smallest plants (if present) were removed to allow the largest to grow. Twice daily the same amount of water (300ml/maize plant; 300ml/Chinese plant) was given to C and DI plants so that irrigation quantity was not a variable, only delivery method.

Figure 1

Figure 2

Results:
Average measurements representing crop yield are shown in **figure 3** (maize) and **figure 4** (Chinese). The average height of DI maize plants was significantly higher than the average height of C maize at each day measured ($p<0.05$ or better). The average length of DI Chinese leaves was significantly higher than the average length of C Chinese leaves on each day measured ($p<0.05$ or better).

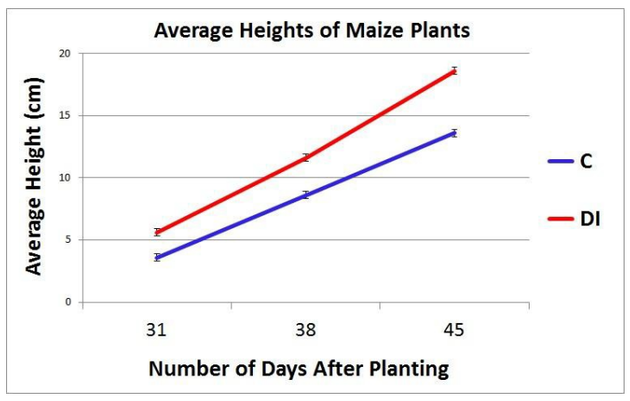

Figure 3

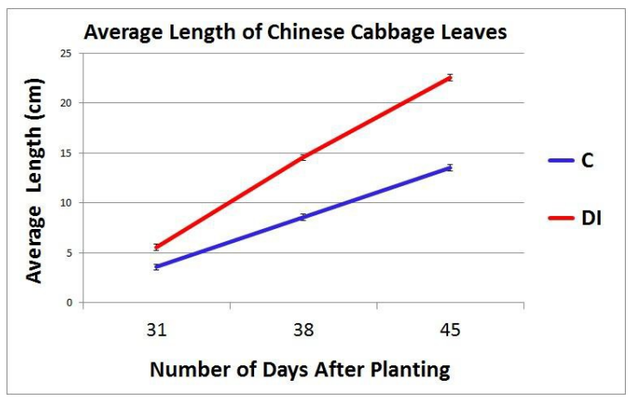

Figure 4

Conclusions:
It can be concluded that this drip irrigation method was better than traditional irrigation because it produced increased growth, which meant improved water efficiency. Perfection of the device can help people in semi-arid regions to reduce required working hours and amount of labour, to preserve water, and to conserve the environment by recycling waste products.

References:
Tagar, A, et al. (2012) Comparative Study of Drip and Furrow Irrigation Methods at Farmer's Field in Umarkot. *World Academy of Science, Engineering and Technology,* 69:863-867.

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