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Growth, yield and water use of vegetable cowpea (*Vigna unguiculata*) grown in bucket lysimeters for crop coefficient determination

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Abstract

As rainfall patterns become unpredictable and water resources increasingly become strained due to climate change, efficient irrigation scheduling becomes critical to maximise yields while conserving scarce water resources. This requires precise knowledge of overall water consumption by the crop which is often obtained through weighing lysimeters. However, standard lysimeters are expensive, therefore not readily available for use. This creates need to develop low-cost lysimeters to make them available at an affordable price and thus contribute to improvement of management of water resources. A simplified lysimeter was therefore made using two buckets. One bucket full of soil with perforations at the bottom to allow water to drain was inserted inside a slightly larger bucket. Excess drainage from inner bucket was collected inside the larger outer bucket. Lysimeters were installed flush with the soil surface and surrounded with rows of plants to allow normal crop growth. Plants in lysimeters and surrounding were allowed to grow optimally. A comparison between plants growing within the lysimeter and those outside was done to determine the effect of the lysimeter on cowpea plant growth. Growth was determined in terms of plant height, number of leaves and number of branches which were used to calculate relative growth rate parameters. Fresh weight and dry weights were estimated. The amount of water used was determined from water balances. All growth parameters did not differ significantly between lysimeter plants and non-lysimeter plants. While relative change in height was 3.623 for lysimeter plants, it was 3.6156 for non-lysimeter plants. Relative change in number of branches was 0.907 for both lysimeter and non-lysimeter plants. Relative change in number of leaves was 7.148 for lysimeter plants, 9.75 for non-lysimeter plants. The Fresh weights were 50g for lysimeter plants and 60g for non-lysimeter plants while dry weight was 6g for lysimeter and 8g for non-lysimeter. The amount of water added to the lysimeter was 3.032 kg, resulting in a water use efficiency of 1.98 g/l water. The results show that bucket lysimeter has no effect on plant growth and therefore may be used providing an easy set up for estimating water use.

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