



IMPACTS OF DRIP IRRIGATION IN CROP CULTIVATION DURING DROUGHT

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1. INTRODUCTION

The survival of the biosphere is threatened by the unavoidable climate changes in the world. Drought is one of the major unwelcomed issues to the farmers in crop production (Basu *et al.*, 2016). Much of the world's population has difficulty gaining access to potable water and adequate food and is often forced to rely on drier and less fertile land (Fedoroff *et al.*, 2010). Water is one of the most valuable resources, and it's becoming scarcer each year (Rijsberman *et al.*, 2006). Existing extreme water scarcity harms food security by reducing the crop yield during drought.

In Sri Lanka, generally traditional flood irrigation methods are used for water supply with high consumption of water (Geekiyanage and Pushpakumara, 2013). These methods are not suitable for drought conditions due to higher water wastage. Lack of considerations in crop water requirements results in lower water use efficiencies in a traditional basin, border and furrow irrigation methods.

Water supply management for no rainfall periods balances the water stress in plants and improves plant growth and development. Due to the low availability of water sources/irrigation systems, need to search for a water management system where efficient usage of water. As per the need, drip irrigation is one of the suitable methods for water supply to the plants in drought conditions (Eissa *et al.*, 2018).

Drip irrigation is a type of irrigation that delivers water to the plant's roots through a system of valves, pipes, and emitters (Bennis *et al.*, 2015). The water seeps out slowly into the soil rather than getting sprayed on the leaves. Drip Irrigation is more efficient than traditional sprinkler or overhead watering systems because it uses less water and less energy. This translates to lower running costs for farmers, who may be able to afford other farming necessities like fertilizer or pesticides with the money they save on water and electricity. It is most often applied in gardens and vegetable fields. It can also be used for an array of other purposes, such as watering lawns, flower beds (Andersson, 2005). Drip Irrigation does not typically work well in all areas or soils, so this research thoroughly covers before implementing this method as an irrigation technique.

In this review study, the applicability and the impacts of drip irrigation for farming will be discussed. The suggestion from this study will be more useful to the farming community to resilience agriculture from drought risks.

2. METHODOLOGY

The impact of drip irrigation in crop cultivation during drought was reviewed with research findings using meta-analysis. The review process was done with research papers from indexed and peer-reviewed journals.

3. RESULTS AND DISCUSSION

Effects of drought in crop cultivations

Drought is a type of abiotic limiting factor for crop production. Plants show some stress tolerance mechanisms in various ways such as physiological interruptions, physical damages in plant parts and cellular biochemical modifications (Hasanuzzaman, 2013). From starting to the germination of seeds, drought influences (Li *et al.*, 2013). Experiments were reported that, the reducing rate of photosynthesis, reduction of assimilate partitioning and lack of leaf development during drought resulted in the lower yield (Zahoor *et al.*, 2017).

Nutrient absorption and water availability are associated with one another for plant health (Singh *et al.*, 2020). And a great degree of water unavailability may lead to death following to wilting of shoots (Frank and Viets, 1967). Drought can cause undesirable photosynthetic mechanisms, changes in pigment concentrations and enzymatic reactions (Liu *et al.*, 2010; Din, 2011). Other than that disturbance in the partition of assimilates and oxidative stresses are shown in plants during droughts (Basu *et al.*, 2016).

Drip irrigation systems

Irrigation is one of the most important steps in crop management. Irrigation systems are used by farmers, large-scale food processors, and small-scale vegetable growers to maintain healthy plants. The cheapest way to maintain healthy crops and produce food for people all over the world is through drip irrigation (Maisiri *et al.*, 2005).

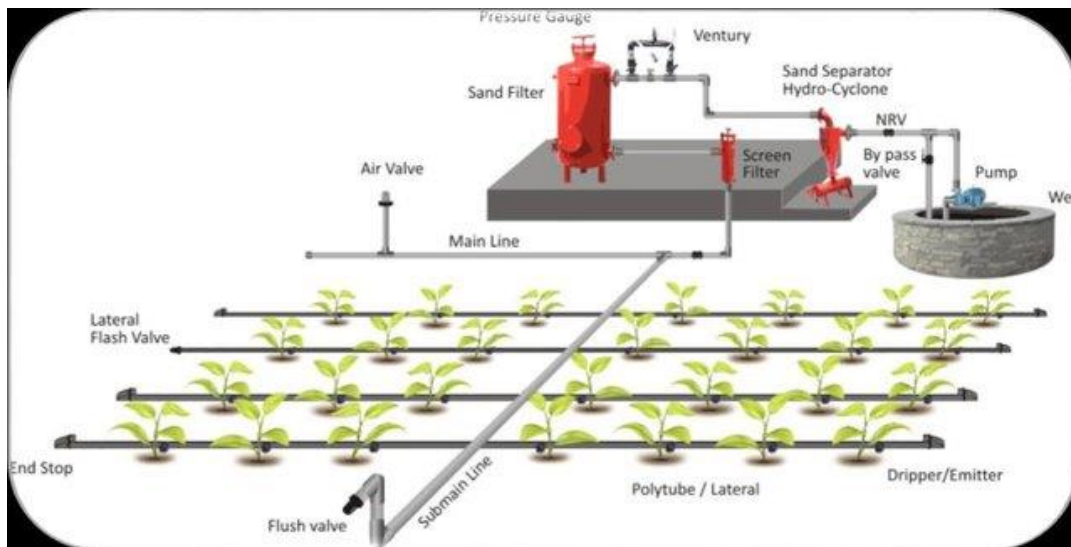


Figure 1: A typical view of drip irrigation system (Jha *et al.*, 2015).

More homeowners are turning to drip irrigation systems because they help conserve water and maintain healthy plants. It is important not only to purchase a good drip irrigation system but also to install and maintain it properly. First, the installation process needs to be done correctly for the system to function at its best. This can be done by the instructions and using high-quality tubing, emitters, and connections. Some manufacturers may recommend a specific way of installing the system such as burying it underground or installing it on top of ground level. Homeowners must follow these guidelines for their system to work properly. The maintenance process also needs to be done well for irrigation systems to continue working properly over time. Checking for leaks and replacing worn.

Positive impacts of drip irrigation

Agriculture is the new arms race. Countries are competing to create higher-yield crops with less water for more sustainable populations. Greenhouses are rapidly growing in popularity as they combat the heat and humidity that would otherwise damage crops. Drip Irrigation Systems are the most efficient irrigation systems for extreme conditions. These systems are capable of providing water to plants in even the aridest climates. The main objective of drip irrigation is to ensure that the water reaches plant roots without being wasted on the surface of the soil or evaporating into thin air. The main objective of drip irrigation is to make sure that water reaches plant roots, but not waste any on the surface or evaporate into thin air (Hillel and Hatfield, 2005).

Drip irrigation is the future of agriculture; it requires substantially less water than traditional methods and leaves no waste behind. With increased water efficiency comes increased crop yields, providing more food for everyone on Earth (Surendran *et al.*, 2005). While drip irrigation is a modern and efficient way to water plants, it's a complicated method that is not easily understood by those who haven't been trained in professional agricultural methods so the Large-scale agricultural systems are inefficient and harmful to the environment. They needlessly waste wastewater, fertilizer, time, and money. With Drip irrigation systems, there's no need for wasteful use of water. Drip irrigation delivers water directly to the roots of each plant because it uses scientifically-calculated amounts of water (Bennis *et al.*, 2015). Weed control is also another advantage in drip irrigations (Thompson *et al.*, 2009).

Several experiments were carried out to find out the efficiency of the drip irrigation system in cultivation. Ravelo *et al.*, (1977) reported that there were no significant differences in the yield or water use efficiency in sorghum concerning drip irrigation and sprinkler irrigation. So the drip irrigation exhibits the same performance as a sprinkler irrigation system. High frequent drip systems followed higher corn yield with lower water usage compared to sprinkler irrigation (Lamm and Trooien, 2003).

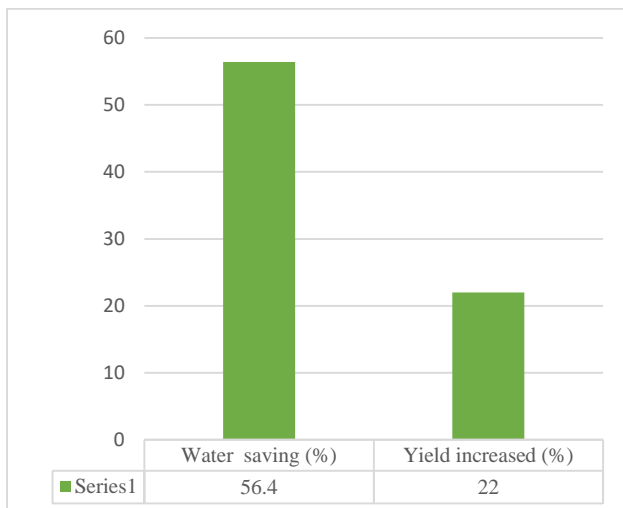


Figure 2: water saving and the yield of the tomato crop in drip irrigation system over furrow irrigation system (Panigrahi *et al.*, 2010)

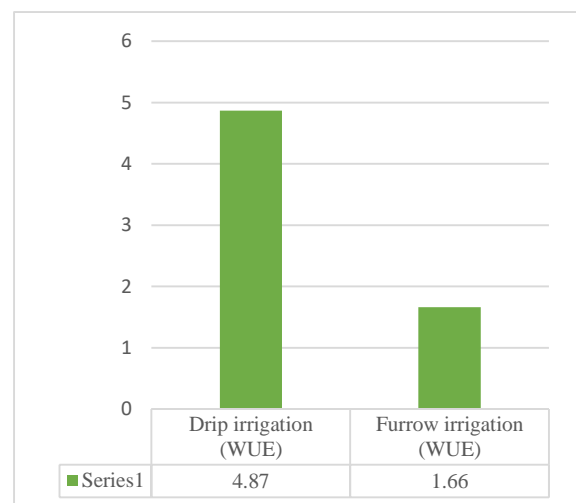


Figure 3: water use efficiency in drip irrigation system over furrow irrigation system (Panigrahi *et al.*, 2010).



Flocculation and coagulation of organic microbial products like clay and algae and the aggregation of some fine soil particles that can block the passage to water is the main issue regarding the drip irrigation system (Ravina *et al.*, 1992). But the efficient filtration system of water before sending it to the mainline will be the solution for that.

4. CONCLUSION

Irrigation is one of the most important steps in crop management. Irrigation systems are used by farmers, large-scale food processors, and small-scale vegetable growers to maintain healthy plants. Drip irrigation is a suitable water supply system for the plant during drought conditions. Compare to the other irrigation system like a sprinkler/furrow, it offers the same and sometimes good performances in yield and water use efficiency. Increase vegetable cultivation with less water, fewer weeds, and fewer herbicides. Drip irrigation will help to conserve the environment and maximize the profit margin. Therefore the cheap and efficient water usage method during drought conditions is drip irrigation.

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