International Journal of Modern Agriculture, Volume 10, No.1, 2021
ISSN: 2305-7246

A Literature Review on Drip Irrigation System

N. N. Saxena [1]

[1] Department of Agriculture, Sanskriti University, Mathura Uttar Pradesh-281401, India.

Corresponding author*:*

N. N. Saxena
Department of Agriculture, Sanskriti University, Mathura Uttar Pradesh-281401, India.

Abstract

Land and water represent the country's fundamental needs for agriculture and economic growth. By 2025, 1/3 of the world's population will face total water shortage. Agriculture consumes over eighty percentage of the exploitable water supplies of the world. The global productivity of the agricultural sector & the expected rate of development in GDP entirely rely primarily on the sagacious utilize of the obtainable water supplies. Therefore, this Micro Irrigation scheme which aim to increase the region under the efficient irrigation techniques via irrigation by Drip technique. Drip irrigation is the effective way of delivering irrigation of water directly to soil in the plant's root areas, reducing typical mislaying such as soil erosion, deep percolation and runoff. This also permits fertilizers, nutrients, & other water-soluble substances to be used along with irrigation water, leading to higher yields and improved production results. Drip irrigation systems is seen the solution to several challenges of dry land cultivation and increasing the output of irrigated cultivation. In view of all these, the present research was planned to research the degree of advantages obtained from drip irrigation in horticultural crops and to recognize the constraints faced by farmers in the adoption of the drip irrigation in horticultural crops.

Keywords: Drip irrigation, Dry land agriculture, Irrigated agriculture, Scheme on Micro-Irrigation, Farmer, Soil, Crop, Growth, Fertilizer, Water scarcity

Introduction

The land and water represent the country's fundamental requirements for agriculture and economic growth. The International Water Management Institute (IWMI) estimates that by the end of 2025, 1/3 of the world's inhabitants will face the absolute water shortage. A process of irrigation was considered necessary for rapid development of agriculture that consumes much than eighty percentages of an exploitable water supplies of world. The overall productivity of the agricultural sector and the expected rate of growth in GDP rely largely on the sensible use of the available water supplies. In India, however, micro-irrigation techniques are actively supported by the national government, state governments, and several local and foreign non-governmental organisations (NGOs) by offering various forms of social, administrative, and technological support systems. Such innovations are marketed mainly a way to conserve water in the irrigated agriculture, it is a tool to raise income & alleviate hunger, to improve the food & nutrition welfare of poor households for one or several of the following purposes [1]. This Micro Irrigation Scheme (MI), which aims to increase the region using effective irrigation techniques viz. Irrigation by drip. Drip irrigation is the effective way for delivering irrigation water undeviating to soil in the plant's root region, reducing typical losses like shallow percolation, drainage, & soil erosion. Drip irrigation is more effective and inexpensive, unlike surface irrigation, if it is applied in water poor regions with undulated topography, deep & sandy soils & heavy-value crops with wide spacing [2]. This also allows fertilizers, nutrients, and other water-soluble substances to be used along with irrigation water, leading to higher yields & improved production results [3]. Thus, the method of drip irrigation is seen as a solution to several of the problem of dry land cultivation and increasing the output of irrigated agriculture. The path of several systems are being applied to facilitate the drip irrigation. Therefore, it is important for the drip irrigation farmers to know the advantages and restrictions of the method in the process of achieving higher output of the drip irrigation.

The Drip irrigation is a form of micro-irrigation device that can conserve energy & nutrients by enabling energy to drip moderately to plant root, either from above the surface of the soil or buried underneath the surface [4-5]. The goal is to specifically inject water into the roots zone to reduce the evaporation. Drip irrigation systems use a network of pumps, tanks, tubes, and emitters to convey water. A drip irrigation system may be more powerful than other forms of irrigation systems, such as ground irrigation or sprinkler irrigation, based on how well it is built, installed, managed, and controlled [6-7].

Many large drip irrigation structures use some form of filters to prevent small waterborne particles from clogging the narrow emitter flow path. New technologies that mitigate clogging are now being offered. Any residential systems are built without extra filters as at the water treatment facility, potable water is still purified. Practically all makers of drip irrigation systems advocate using filters and do usually not respect warranties until this is achieved [8-9]. Owing to small particle settling and unintended injection of particles into the intermediate layers, last filters line just before a final transmission pipe will highly advised in addition to every another filtration device. Drip and surface drip irrigation is used nearly entirely as the urban wastewater is treated. Usually, the rules do not require water to be pumped into the air that has not been thoroughly handled to the requirements of potable water.

Standard surface formulations of timed-release fertilizer are often inefficient due to the current ways the water is treated in the drip system, because the drip mechanisms sometimes blend liquid fertilizer with the irrigation water [10]. It's called chemigation & fertigation (application of toxins & other substances to regularly flush out the body, like sulfuric acid or chlorine) using chemical syringe like diaphragm motors, aspirators or piston engines. The chemicals can continuously have applied while the device irrigates at the intervals. From recent university field studies, the use of the fertilizer savings of up to ninety five percentage was recorded using drip fertilization and slow water distribution relative to accelerated discharge and micro-spray head irrigation. Properly planned, built and controlled, drip irrigation can help to accomplish water efficiency by minimizing evaporation and deep runoff relative to other irrigation types such as overhead or flood sprinklers, as water can have delivered more directly to the plants roots [11-13]. Additionally, drip can remove many diseases transmitted by contact with the vegetation through spray. Lastly, there could be no real water savings in regions where water sources are extremely reduced, but instead merely an increase in demand by consuming the same volume of water as before. The alternative approach is to spread irrigation water as lightly as possible in very arid areas, or on sandy soils.

Capacity of Drip System:

The factors that plays crucial role in maintaining the capacity of the Drip System is listed herein:-

- The water requirement for the process of drip irrigation.
- The operating hours required for actuating the process of drip irrigation on the agricultural crops.
- Interval between two consecutive drip irrigation that is performed on the agricultural crops by the farmers.
- Efficiency of the application of the water on the root portions of the agricultural crops.

The drippers involved in the drip irrigation are closely installed to each of the root portions of the agricultural crops. The lateral involved by the drip irrigation technique is placed along each row(s) of the agricultural crops [14]. And the number of lateral placed at the row(s) of the crops are taken almost equal to the overall growth of the agricultural crops.

- In the case of the close growing agricultural crops, the entire agricultural area is required to be wetted and moisturized properly.

- The drippers included in the drip irrigation technique is used to turn as a line source of the water rather than a point source, so that the dripped water directly falls in the root portions of the agricultural crops.
- However, in case of the closely spaced agricultural field crops, large number of the drippers are needed to carry out the drip irrigation technique.
- The process of operation and installation of such large scale drippers unit(s) are prone to many problems while used for a large period of time.
- Therefore, there is implementation of the emitting pipes inbuilt with dripper units placed at an optimal distance from each other along the lateral pipe(s) to carry out a preferred drip irrigation.

The distance between two drippers, laterals and number of drippers per lateral in closely growing crops is determined by taking into account the displacement of the water front with period in vertically and horizontally direction in the soil in near developing agricultural field crops [15].

Lay out of Drip Irrigation Technique:

- The main and sub-main pipes are usually spread around the slope, and the laterals are positioned along the slope.
- The laterals can be allowed to take off directly from the main pipe in a specific area of the agricultural field.
- It may be best to split it into blocks and wide fields. Each block can have one Sub-main and a control valve. Lateral pipes are connected to sub-mains.
- Reasonable structure and components to ensure sufficient, consistent delivery of water (and fertilizer) through the field to fulfill crop requirements.

The considerations of the Lay out of the Drip Irrigation Technique:

- Operational
- Water Quantity
- Challenges faced to maintain the quality of the water
- Economical

Use of Filters in the Technique of Drip Irrigation:

- The implementation of the filter is a crucial part of the drip irrigation techniques.
- Filters are used to reduce or avoid the potential inflow of suspended material into the water through the pipe spacing and dripping network.
- The sort of filter the farmers require depends on the consistency of the water and the drip system working speed.
- There is presence of four common filter types that include sand filter, panel filter, hydro-cyclone filter and disk filter.
- Each filter design is efficient for a particular particulate matter and form of suspended substance, for a particular flow rate, and has a limited capacity to capture sediments.

Characteristics of Fertilizer Applicators:

- Application of fertilizer by the process of drip technique requires a supplementary unit in the proposed network for effectiveness in the growth of the agricultural crops.
- Enables liquid fertilizers or fine grained fertilizers to be distributed simultaneously in aqueous solution.
- Selecting a suitable fertilization device such that the application of fertilizer can be done within a suitable period without increasing the risk of excessive watering.

Methods of Fertigation:

- Fertilizer tank (By-pass Technique)
- Implementation of the "Venturi Pump"
- Use of the Injection Pump.
- Non-corrosive material can be utilized for the injection devices and the fertilizer tanks.

Water Requirement:

The irrigation water necessity of an area is based on following factors enlisted below:

- Sort of Agricultural crops (Crop-coefficient)
- Source of water that is to be used during the process of Drip Technique.
- Data of the Weather and Climate (i.e. Evaporation Data)
- Type of soil, wherein the crops are grown.
- Cultivated area of the Agricultural crops.

Objective:

In view of all these, the present research was planned to research the degree of advantages obtained from drip irrigation in horticultural crops and to recognize the challenges faced by farmers in the implementation of drip irrigation in horticultural crops.

- Drip irrigation aims to improve water usage in cultivation by distributing water & or minerals directly to the crop's roots via emitters.
- Ensure adequate moisture for plant development.
- Start providing crop protection towards drought in a limited time duration.
- Both soil and weather get cooled to create an optimal climate for the growth of the crops.
- Wash away the dilute toxic salts and unwanted soil chemicals from the roots region of the agricultural crops.
- Drip irrigation is the main effective method for providing water and nutrients for the growth of the agricultural crops.
- It provides organic matter straight to the roots system of the crop, in the correct quantities, at the proper time so that every plant receives just what it required to develop optimally when it requires.

- Usually operated at reduced pressure than most other pressurized irrigation methods, thus reducing power costs.
- Foliage stays healthy, thereby reducing disease risk.
- Fertigation can be effectively implemented with minimum fertilizer loss.
- Supply differences may be controlled by regulating the valves and drippers unit(s).
- The labor costs are lower than other forms of irrigation.
- The water distribution is highly uniform, controlled by the output of each nozzle.
- Growth of the weeds are lessened and brought into control.
- Erosion of the soil is minimized.
- Soil type plays some less important roles in the frequency of irrigation.

METHODOLOGY

The present research was performed in the Tamilnadu, district of Dindigul. The study used the expost -element analysis method. A group consisting of 30 gout irrigation farmers were randomly chosen from the three R.P villages intentionally chosen. Pudhur, Manjanaickenpatty and chatrapatti in the taluks of Oddanchatram, where the highest area of the horticultural plants is irrigated by drip system. The survey was designed to hold the research goals in the context, introduced in non-sampling field and then used to gather the data from the respondents needed. The questionnaire used in this study was adapted from the previous English language literature, that was validated and subsequent changes were made before the final questionnaires that were required to be administered.

DISCUSSION AND RESULTS

Analyzed gathered knowledge as well as findings summarized in the Table 1 below.

Table 1: Benefits of Drip Irrigation

S. No.	Benefits of Drip irrigation farmers	No. expressing the advantages	
		Number (n= 30)	Per cent (%)
1.	Saving of water	27	92.38
2.	Saving of labour cost for irrigation	24	74.36
3.	Uniform application	25	93.12
4.	Improved quality of produce	22	62.63
5.	Easy method of irrigation	27	83.65
6.	Decreased weed growth	19	74.21
7.	Increased crop yield	26	75.62

*Multiple responses possible

The above Table 1 revealed that majority of the respondents opined that saving of water (92.38 percentage) is major benefit of drip irrigation and followed by Uniform application (93.12 percentage), Easy method of

irrigation (83.65 percentage), Increased crop yield (75.62 percentage), Saving of labor cost for irrigation(74.36 percentage), Decreased weed growth(74.21 percentage) and Improved quality of produce (75.62 percentage).

Challenges faced by the drip irrigation farmers:

A challenges faced by the farmers had the issue of the un-availability of standard products, no follow-up service rendered by the drip agents, higher starting investment costs, and lacks of funds to cover the full investments under drip irrigation & delay in loan penalties, leakage in new drip process.

CONCLUSION

The advantages faced by the farmers are water-saving, standardized implementation & simple irrigation system, & the restrictions are the issues of the non-availability of quality content & the shortage of drip agent follow-u facilities. From the report, it is clear that the drip irrigation companies, funding organizations and others have sufficient model spare parts and other necessary steps to ensure a suitable situation for proper implementation of the drip irrigation systems.

The findings showed that the majority of gout irrigation farmers had reported benefits such as water savings, labor cost savings for irrigation, improved yields, energy savings, labor savings, improved product quality, reduced weed production, expanded product self-life and standardized energy distribution. The challenges faced by the farmers had problems with the non-availability of good material, no drip agency follow-up facilities, high initial expenditure costs, lacks of funds to finance full holdings under drip irrigation, delay in loan penalties, and leakage in the new drip scheme.

REFERENCES

1. A. S. Ati, A. D. Iyada, and S. M. Najim, “Water use efficiency of potato (Solanum tuberosum L.) under different irrigation methods and potassium fertilizer rates,” Ann. Agric. Sci., 2012, doi: 10.1016/j.aoas.2012.08.002.

2. Y. B. Çolak, A. Yazar, İ. Çolak, H. Akça, and G. Duraktekin, “Evaluation of Crop Water Stress Index (CWSI) for Eggplant under Varying Irrigation Regimes Using Surface and Subsurface Drip Systems,” Agric. Agric. Sci. Procedia, 2015, doi: 10.1016/j.aaspro.2015.03.042.

3. A. D. Chukalla, M. S. Krol, and A. Y. Hoekstra, “Green and blue water footprint reduction in irrigated agriculture: Effect of irrigation techniques, irrigation strategies and mulching,” Hydrol. Earth Syst. Sci., 2015, doi: 10.5194/hess-19-4877-2015.

4. M. Albaji, M. Golabi, S. Boroomand Nasab, and F. N. Zadeh, “Investigation of surface, sprinkler and drip irrigation methods based on the parametric evaluation approach in Jaizan Plain,” Journal of the Saudi Society of Agricultural Sciences. 2015, doi: 10.1016/j.jssas.2013.11.001.

5. H. M. Darouich, C. M. G. Pedras, J. M. Gonçalves, and L. S. Pereira, “Drip vs. surface irrigation: A comparison focussing on water saving and economic returns using multicriteria analysis applied to cotton,” Biosyst. Eng., 2014, doi: 10.1016/j.biosystemseng.2014.03.010.

6. S. Gerçek, M. Demirkaya, and D. Işik, “Water pillow irrigation versus drip irrigation with regard to growth and yield of tomato grown under greenhouse conditions in a semi-arid region,” Agric. Water Manag., 2017, doi: 10.1016/j.agwat.2016.11.012.

7. S. Qin, S. Li, S. Kang, T. Du, L. Tong, and R. Ding, “Can the drip irrigation under film mulch reduce crop evapotranspiration and save water under the sufficient irrigation condition?,” Agric. Water Manag., 2016, doi: 10.1016/j.agwat.2016.06.022.

8. D. B. Rowe, M. R. Kolp, S. E. Greer, and K. L. Getter, “Comparison of irrigation efficiency and plant health of overhead, drip, and sub-irrigation for extensive green roofs,” Ecol. Eng., 2014, doi: 10.1016/j.ecoleng.2013.12.052.

9. P. L. Eranki, D. El-Shikha, D. J. Hunsaker, K. F. Bronson, and A. E. Landis, “A comparative life cycle assessment of flood and drip irrigation for guayule rubber production using experimental field data,” Ind. Crops Prod., 2017, doi: 10.1016/j.indcrop.2017.01.020.

10. Y. Garb and L. Friedlander, “From transfer to translation: Using systemic understandings of technology to understand drip irrigation uptake,” Agric. Syst., 2014, doi: 10.1016/j.agsy.2014.04.003.

11. J. Reyes-Cabrera, L. Zotarelli, M. D. Dukes, D. L. Rowland, and S. A. Sargent, “Soil moisture distribution under drip irrigation and seepage for potato production,” Agric. Water Manag., 2016, doi: 10.1016/j.agwat.2016.03.001.

12. S. Eroglu, U. Sahin, T. Tunc, and F. Sahin, “Bacterial application increased the flow rate of CaCO 3-clogged emitters of drip irrigation system,” J. Environ. Manage., 2012, doi: 10.1016/j.jenvman.2011.12.014.

13. M. A. Adekoya et al., “Agronomic and Ecological Evaluation on Growing Water-Saving and Drought-Resistant Rice (Oryza sativa L.) Through Drip Irrigation,” J. Agric. Sci., 2014, doi: 10.5539/jas.v6n5p110.