Section A-Research paper
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CLOGGING EFFECTS OF DRIP EMITTER WITH FRESH WATER AND MUDDY WATER

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ABSTRACT

Emitter clogging is the common and serious problem associated with drip irrigation. An attempt was made to study drip emitter clogging with the objective of comparing relative emitter discharge, reduction of mean discharge, emission uniformity, and percentage of completely clogged emitters. Experiments were conducted at different concentration of clay viz. 5% and 10% and at different operating pressures viz. 0.6 kg/cm2, 0.8 kg/cm^2 and 1 kg/cm^2. mitter perfomances under different treatments were analysed. Emitter discharge variation with operating pressures for online and inline drip emitters were studied. Clogging was maximum in case of inline drip emitters at higher pressures and at lower pressures few online drip emitters were also clogged. At higher operating pressure, online drip emitters work satisfactorily without clogging. Similarly, mean discharge reduction of inline drip emitters were more at higher operating pressure and at lower pressures discharge of online drip emitters were less. Percentage of completely clogged inline drip emitters was 25%, whereas that of online drip emitters was 5 % only.

Keywords: Online drip emitter, Inline Drip emitter, Drip irrigation

INTRODUCTION

Water a life sustaining resource, closely linked to the quality of life, a renewable resource is getting deteriorated in terms of quality as well as quantity. The international water management institute forecasts that by 2025, 33 percent of India's population will live under absolute water scarcity condition. The per capita water availability in terms of average utilizable water resources in the country has dropped drastically from 6008 m^3 in 1947 to 1250 m^3 now and is expected to dwindle to 760 m^3 by 2025.

Water is one of the critical input for sustainability of agriculture, which consumes about 80% of available water but irrigation efficiency, continue to be only about 40%. Presently the problem facing the country is not the development of water resources but the management of the developed water resources in a sustainable manner. By adopting efficient water management practices the bulk of India's agricultural lands could be rendered as irrigated. Therefore the need for enhancing the efficiency of irrigation has been emphasized to safe guard the interest of farmers & avoid water crisis.

As far as the Indian agriculture is concerned, irrigation plays a crucial role in the various development projects of the country. The existing methods of irrigation and the available facilities are not reliable and we are forefronted with lot many problems regarding soil and water. A major challenge is to develop systems for greater precision in water and plant nutrient control, so as to increase the use efficiencies of soil, water and energy resources and to improve the environment for mankind. Expansion of irrigation is also essential for increasing food production for the alarming Indian population of one billion at present. With present potential of 114 M ha m of water, only 57 M ha (40%) is under irrigation in India against the total cultivated area of 145 M ha. Therefore the effective management of water resources is essential to meet the increasing competition for water between agricultural and non-agricultural sectors. Also plans are to be introduced to reduce the present day share of 90% of water used for agriculture to 75 to 80% in the coming decades. This necessitates the scientific management of the available water resources in agricultural sector.

Research activities in the field of micro irrigation systems are conducted all over the country through ICAR institutes and State Agriculture Universities, AICRP on water management, DRIPNET project and Adhoc schemes. The ministry of agriculture through NCPAH, which has 17 precision farming development centers (PFDC) located in different agro climatic conditions has also focused attention to develop regionally differentiated technologies on micro irrigation, besides imparting training to a large number of farmers and department staff. Now the adoption of the micro irrigation system has started in areas having water scarcity, poor quality water and undulating terrain.

More over the soils of Kerala State being under good in infiltration and low water holding capacities, surface methods of irrigation are inefficient causing frequent irrigation and excess wetting of soils by wasting water. The adoption of sprinkler and drip irrigation in such conditions improve the irrigation efficiency considerably over the surface methods. The State water bodies especially well in the coastal regions have high salt content. Hence adoption of drip irrigation opens the chances of using the saline water for irrigating crops like coconut. In most of the homestead farms in Kerala, agriculture irrigation is well based and quality of water is excellent. This helps in less problem of clogging. Hence there is ample scope for adoption of this advanced technique of irrigation in Kerala.

Surface irrigation method, with an overall efficiency of only 20 to 50 per cent usually causes erosion, salinisation and water logging problems. Two important aspects to be considered in this regard are uniform water distribution in the field and accurate amount of water application by permitting accurate delivery control. These requirements are accomplished by adopting the promising micro irrigation techniques.

The micro irrigation system is one of the most efficient methods of water application directly into soil at the root zone of plants. Simca Blass, a water engineer, originated drop by drop application of water to the plants through the drip irrigation system in Israel in the early 1960’s. Now a days this system of irrigation finds its roots in countries like America, Australia, South Africa, Southern Europe etc. In India it was introduced in the early 70’s and during the last few years this system has started gaining momentum. About 4 lakh ha of cultivated lands in India utilize this system of irrigation. Among the states, Maharashtra is the leading state covering 6,04,440 ha under micro irrigation followed by Andhra Pradesh with 5,05,205 ha and Tamil Nadu with 2,26,773 ha (March 2010). It is also expected that the projected area of 10 M ha will be brought under micro irrigation by the year 2020 / 2025 AD. About 55 per cent of the total area of Kerala State with a humid tropical climate is under agriculture. As per the assessment of the Directorate of Economics and Statistics the net irrigated area in the state as on March 2010, is 3.86 lakh ha and the gross area irrigated is 4.54 lakh ha. The net area irrigated has declined from 3.99 lakh ha during 2008-09 to 3.86 lakh ha in 2009-10. Only 16.34 per cent of the net cropped area is irrigated. The area under micro irrigation in Kerala is as low as 15,885 ha (2010). So there is still ample scope, for this technique of irrigation in Kerala.

Micro irrigation which includes mainly drip and micro sprinklers is an effective tool for conserving water resources. It is an irrigation system with high frequency application of water in and around the root zone of plant system, which consists of a network of pipes along with suitable emitting devices. It permits a small uniform flow of water at a constant discharge, which does not change significantly throughout the field. It also permits the irrigation to limit the watering closely to the consumptive use of plants. Thus it minimizes the conventional losses such as deep percolation, runoff and soil evaporation. It also permits the utilization of fertilizer, pesticides and other water-soluble chemicals along with irrigation water for better crop response.

The micro irrigation system is generally classified on the basis of its installations in the field i.e. surface method or subsurface method. The advantages of surface drip irrigation are well proved and documented. Subsurface drip irrigation is an advanced and recent revolutionary variation of traditional drip irrigation where the tubing and emitters are buried beneath the soil surface such that the wetting front lies at least as high as 45 – 60 and as low as 10 – 15 cm below the soil surface. Besides having all the benefits of surface drip irrigation it has some additional advantages. The major advantages of subsurface drip irrigation are improvement in soil water status for crop which results in faster maturity of crops, saving of scarce precious water and improving irrigation efficiency by about 30% over conventional drip irrigation. Weed problem is almost nil, as the surface of the soil remains dry. Heavy textured soils are well suited for subsurface drip irrigation where applicability of surface drip irrigation has been found to be difficult. Soils having very high water intake rate and stones in substratum are not suitable for subsurface drip irrigation. In subsurface drip system for a sufficiently long time flow in a medium to heavy textured soils remain spherical. Frequency of irrigation is quiet high ensuring the spherical flow geometry to be sufficient for emitter spacing and lateral depth calculation. The subsurface drip has got additional advantage of applying domestic effluent with least contamination risk of agricultural produce and field workers hence subsurface drip irrigation with domestic wastewater is a promising option nowadays. It also holds the promise of reducing weed growth, fertilizer and chemical use, labour requirement and optimising water use.

The most common and serious problem faced by drip irrigation system is clogging of emitters. The blockage of system or emitter clogging is the gradual closing of emitter opening due to settlement of sediments contained in the water thus causing reduction in discharge. Emitter clogging can be caused by physical, chemical and biological factors. The significant contributer to this problem depends on the conditions of the use of the system. The emitter clogging depends on water quality, rate and pressure of discharge, size of mesh opening of the filter and diameter of the orifice of the emitter.

The common physical factors are suspended clay,silt, fine sand, plastic particles and also plant, animal and bacterial debris. The common chemical factors include the precipitation of carbonates of calcium or magnesium, calcium sulphate, iron oxides and fertilizers added to the water. Biological factors are bacteria and algae that form filamentous slimes and chemical deposits.

The clogging problem can result in complete rejection or severe restriction of this promosing, efficient method of water application. Filteration with the help of sand and screen filters can avoid clogging problem to a certain extent. Sand filters are not commonly used as they are costly. Construction of sedimentation tanks for removing heavy silt load before filtration is also in practice. Acid treatment or acid flushing for removing chemical clogging is usually practiced. The common acids used for this purpose are hydrochloric acid, sulphuric acid and nitric acid.

In this project is an attempt is made to study the clogging problems associated with inline and online drip emitters. The objectives of this work are

1) To compare of extent of clogging of inline and online drip emitters.
2) To study the effect of clogging on emission uniformity of inline and online drip emitter
3) To study the effect of clogging on discharge of emitters.
4) To study the effect of pressure on discharge of emitters.

The micro irrigation system is one of the most efficient methods of water application directly into soil at the root zone of plants.Micro irrigation which includes mainly drip and micro sprinklers is an effective tool for conserving water resources.Generally the emission devices which deliver water in the following three different modes are termed as micro irrigation systems. They are

1. Drip mode: In drip mode water is applied as droplets or trickles
2. Bubbler mode: In bubbler mode water bubbles out from the emitters

3. Micro sprinkler mode: Water is sprinkled, sprayed or misted.

Burt, (1998) reported that there are many variations of drip/micro irrigation systems. This classification is based on agronomic or horticulture requirements. For frost protection micro sprinkler/sprayer designs offer better climatic control than emitters. For enabling one to irrigate alternate tree rows without wetting the soil around adjacent rows, drip emitters are preferred. An orchard crop with an extensive shallow root system will perform better under micro sprinkler/sprayer than under drip. Emitters are often spaced in arid regions so that at least 60% of the potential root zone volume is wet, which provides an adequate moisture reservoir for the periods of high evapo-transpiration and as insurance against several days of breakdowns.

Atre, A. A.(1998) *et.al*. described the pressure discharge relationship for drip tubing by power function. Drip tubing is made up of flattened polyethylene of 16.5 mm diameter with emission points spaced at 0.3 m on level platform. The pressure dissipating long flow path is 0.3 m long with twists and turns at right angle integrated in the tubing. The discharge exponent ranged in between 0.46 to 0.64 indicating the emitters of drip tubing are partially pressure compensating. The head loss in drip tubing in terms of discharge was found to be a quadratic relation. The various friction factors such as Hazen-William's coefficient, Darcy-Weisback friction factor, Scobey's resistance coefficient, Fannings and Blassius friction factors are 112.8, 0.0127, 0.593, 0.0375 and 0.0367 respectively. The values of emission uniformity of integrated drip tubing were found to be more than 90%, which is acceptable.

Kishor *et.al*. (2005) tested the hydraulic performance of market available drippers. He used an automatic dripper testing setup for the study. The drippers were tested for pressure relation, Pressure and coefficient of manufacturing variation relation, barb losses and uniformity coefficient. The pressure and discharge relations were developed for all drippers by fitting power equation to the data. The drippers had the CVm less than 5 % indicating the good performance, 5-10 % indicating the average performance while CVm more than 10 % indicated the unacceptable range of performance. The uniformity coefficient of dripper was found to be more than 95 % at all operating pressure from 50-300 K Pa.

Howell and Hiler (2005) reported that the flow conditions in the sub main and laterals of a drip irrigation system can be considered as steady and spatially varied with lateral outflows. The flow from the sub mains into the laterals or the out flow of each emitter from a lateral is controlled by the pressure distribution the sub main and lateral lines. The variation of discharge from emitters along a lateral line is a function of the total length and inlet pressure, emitter spacing and total flow rate.

Powar *et. al.* (2001) Conducted a study on cane wall of 15.87 mm inner diameter and placed at 15 cm beneath soil surface for different length of 25, 50, 75 and 100 m with the outlet spacing of 30 cm to evaluate moisture distribution pattern and moisture advance under different rates of discharge (3, 4 and 5 lph/meter) at different irrigation intervals (1, 2 and 3 days) 0, 24 and 48 hrs after irrigation. The experiment was performed in vertisol. The vertical and radial movement of moisture decreased with increase in discharge rate and increased with irrigation interval. The radial movement of moisture was observed maximum 24 hr after irrigation. About 30 % moisture contour moved faster in first 24 hrs compared to the next 24 hrs. Also that advanced in 48 hrs for 3 days irrigation interval vertically and radially up to 75 cm and 60 cm respectively. Vertical and radial movement of moisture were observed up to 85, 80 and 75 cm and 54, 45 and 45 cm in 48 hrs at 3, 4 and 5 lph/meter discharge respectively. The radial and vertical spread of moisture was more for 3 lph/meter than 4 and 5 lph/meter as the time of application of irrigation was more for the same volume of water applied. The vertical movement of moisture decreased with increase in discharge rate of cane wall and increased with irrigation interval.

Phene *et.al*. (1985) reported a comparative study of surface and subsurface drip on Tomato crop. Yield data indicates that tomatoes irrigated by subsurface system at their high or low frequency when the same amount of irrigation water was applied. Water use efficiency of the subsurface drip irrigated tomatoes was 17 and 23 % higher than those of the high and low frequency surface drip irrigated tomatoes.

Ben-Asher and Phene (1993) reported that subsurface may improve irrigation efficiency by 30 % over surface drip. Weed problem is almost nil on the surface of the soil since it remains dry. Subsurface drip may be adopted for safe disposal of domestic effluent and reuse for irrigation with least contamination of agriculture produce. The major agronomic advantage of subsurface drip results from maximising transpiration at the expense of minimising evaporation. This characteristics manifies the performance of drip irrigation by improving crop water status and hence yield, while reducing evaporation losses. A possible disadvantage of subsurface drip is its small wetted radius and this requires more emitter per unit length and area inorder to obtain overlapping of wetted front from two adjacent point sources.

MATERIALS AND METHODS

A study was conducted to evaluate and compare the performance of inline and online drip emitters with the application of freshwater and muddy water. Materials used for the study and the methodology adopted for achieving the objectives are discussed in this chapter.

3.1 Location

The location of the study was KCAET Tavanur, situated at 10º 53'33" N latitude and 76º E longitudes. Agroclimatically, the area falls within the border line of Northern zone, Central zone and Kole land of Kerala. The area receives rainfall mainly from the South-West monsoon and to certain extends from the North-East monsoon. The climatological data of the experimental area is shown below.

Mean maximum temperature : 27 ^{0} C
Mean minimum temperature : 22 ^{0} C
Average relative humidity : 83 %

Average annual rainfall : 2500 mm
Mean evaporation : 6 mm / day
Mean solar radiation : 85 W/ m^2 / day

3.2 Installation of experimental setup

The experimental setup was installed at KVK Malappuram, which include the following;

1) Laying main line and submains
2) Fitting of filter unit and fertigation unit
3) Laying of laterals and emitters.

Plate 1. Installation of experimental setup

The layout of the experiment set is shownin plate 1. The size of the experimental plot is 4.5 m × 5 m with mainline and laterals fixed on a supporting frame to facilitate collection of discharge in to the catch cans. The details of components are given below.

3.2.1 Water tank

A water tank having a capacity 1000 litres was used to supply water for the experiment. The tank was placed at a height 7.5 m above the ground level to provide sufficient head for the operation of drip irrigation system.

3.2.2 Main line and Laterals

A 40 mm diameter PVC pipe was used as main line. The key component of the drip irrigation system is the lateral which delivers water to the crop root zone. The laterals are made of Low Density Poly Ethylene (LDPE) having nominal diameter 16 mm. End caps were provided at the end of each lateral which helps in periodic flushing of the laterals.

3.2.3 Online Drippers

Pressure compensating type dripper having a discharge capacity of 4 lph was used for the study. These are manufactured with high quality flexible rubber diaphragm or disc inside the emitter that delivers uniform discharge.

Plate.2. Online drip emitters

3.2.4 Inline Drippers

Pressure compensating type drip emitters manufactured from high performance polyethylene were used for the study. Drippers were cylindrical with an inbuilt silicon diaphragm. Discharge rate of the selected dripper was 4 lph. Emitters were spaced 60 cm from each other. Diameter of tube was 12 mm.

Plate.3. Inline drip emitters

3.2.5 Control unit

A gate valve was provided at the delivery line of the main pumping system to control the discharge rate. A dial pressure gauge of 0 to 7 kg/ cm^2 was installed at the outlet port of the filter to note the operating pressure.

Plate.4. Filter unit and pressure gauge

The filter unit was fixed on the delivery side of the water distribution system. The filter size was selected in accordance with the capacity of the system. It consisted of a double perforated cylinder in a metallic container for removing the foreign materials. Nominal size of the filter was 2’’ (50 mm) with mesh size of 100 micron (120 meshes). Nominal pressure rating was 1.5 kg/cm^2 and nominal flow rate was 18 m^3/hr.

3.2.6 Ball valve assembly

Ball valves having diameter of 40 mm was used on the sub mainline to control the flow into each block. The time of operation of these ball valves were controlled according to the requirement of the irrigation to the individual field.

3.2.7 Fertigation tank for incorporating mud water to the system

A low cost fertigation tank of capacity 25 litre, developed by KVK Malappuram using plastic material locally available in the market was used for incorporating muddy water which is shown in the Plate 4.

Plate .5. Fertigation tank

3.3 Treatments

The treatments selected for the study are given below

T1- inline drip emitter with fresh water
T2- online drip emitter with fresh water
T3- inline drip emitter with 5% clay concentration
T4- online drip emitter with 5% clay concentration
T5- inline drip emitter with 10% clay concentration
T6- online drip emitter with 10% clay concentration

Initially, the experiment was carried out with fresh water (T1 and T2). Discharge rate of each emitter at different operating pressures were observed. After the first two treatments the system was supplied with muddy water having 5% clay concentration (T3 and T4) and finally with 10% clay concentration (T5 and T6) and corresponding readings were taken.

3.4 Performance evaluation of inline and online drip emitters with fresh water

Performances of inline and online drip emitters were compared using freshwater. The discharges were collected for duration of 10 minutes. The experiment was repeated at different pressures. Discharge was measured and readings were tabulated.

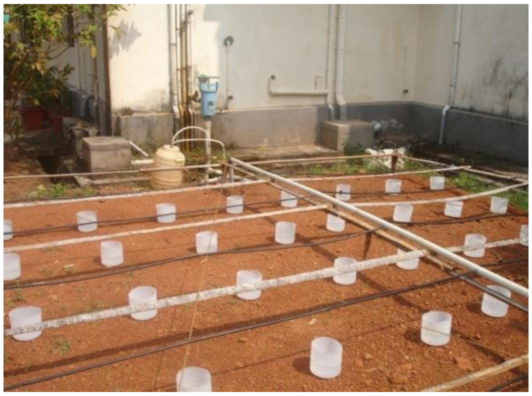


Plate.6 Discharge collection of fresh water

3.5 Performance evaluation of inline and online drip emitters with muddy water

Muddy water with 5% clay concentration and 10% clay concentration were supplied into the system with the help of fertigation tank.

3.5.1 Preparation of clay suspension

The clay was collected from paddy field of KCAET farm. The dried clay was crushed and powdered. Using a sieve shaker clay particles of size less than 75 micron, passing through IS 75 sieve were collected.

Two treatments with 5% and 10% colloidal clay water were given to the emitters. The amount of clay required was calculated on the basis of volume of fertigation tank which is used to incorporate the clay suspension in system.

The volume was 25 litre= 25kg
So 5% clay weighs about 1.25kg
10% clay weighs about 2.5kg

The clay powder was thoroughly mixed with water in fertigation tank and is connected to the system through valves.

3.6 Parameters recorded

The performances of the emitters were evaluated based on the following

3.6.1 Discharge rate of emitters

Discharges of emitters were collected in catch cans and depth of water was measured and the observation was repeated for all treatment. Discharge was calculated by multiplying depth of water in catch can with the cross sectional area and is converted to litre per hour.

s.

Plate.7 Discharge rate of emitters

3.6.2 Relative emitter discharge

Relative discharge is a measure of decrease or increase in mean discharge of a type of emitter during the operation.

Relative emitter discharge was calculated using the fomula

$R = \bar{q}/q_{ini}$ ------------------------------------- (1)

Where $\bar{q}$= Mean discharge of emitter in each lateral in lph

q_{ini} = discharge of initial emitter in lph

3.6.3 Reduction of mean discharge

Reduction of mean discharge was calculated using the formula

$q_{reduction} = 100(1- R)$ -------------------- (2)

R= relative emitter discharge

3.6.4 Emission uniformity

Emission uniformity for drip irrigation means that all emitters controlled by the same control head should have same discharge as close as possible. In field, water distribution efficiency of system is closely related to emission uniformity.

EU analysis was done on the mean of lowest ¼ of the flow rates among the emitters.

Emission uniformity was calculated using the formula

$EU = 100 (q_{min}/\bar{q})$ **----------------** (3)

q_{min} = minimum discharge of emitter in each lateral in lph

$\bar{q}$ = mean discharge of emitter in each lateral in lph

In this study average discharge of lowest ¼ of the emitters was taken as discharge of one emitter with least discharge since total number of emitters was four per lateral and mean of all the five laterals was taken for calculation. The variation in EU's were calculated for different treatments and with different pressure.

3.6.5 Percentage of completely clogged emitters

$P_{clog} = N_{clog}/N*100$ **-----------------** (4)

N_{clog} = number of completely clogged emitters.

N = total number of emitters

RESULTS AND DISCUSSION

A laboratory study was conducted to determine clogging effects of inline and online drip emitters with fresh water and muddy water. The experiment was conducted during November 2011- January 2012. The results obtained from the study are analysed and presented in this chapter.

4.1. Discharge rate of emitters

Discharge rate of emitters calculated for various treatments were plotted against different operating pressures, which is shown in Fig. 4.1 to Fig. 4.3.

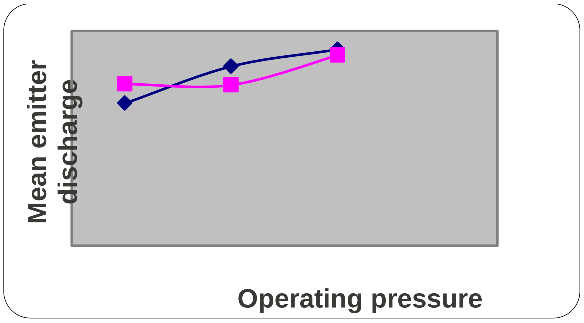


Fig. 4.1.Mean emitter discharge for freshwater

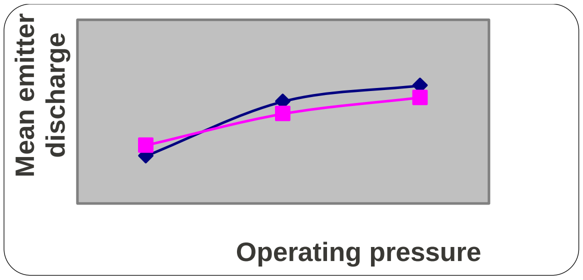


Fig.4.2 Mean emitter discharge for 5% clay suspension

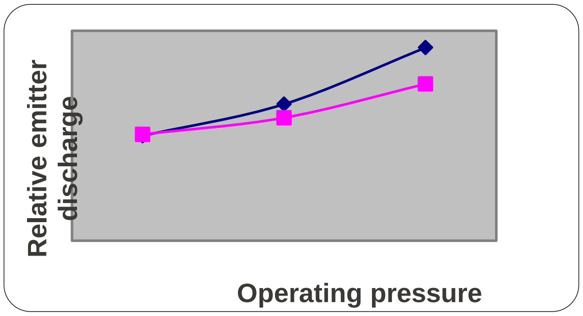


Fig: 4.3 Mean emitter discharge for 10% clay suspension

From the graphs it is clear that at lower operating pressure the discharge of online drip emitters were less when compared to inline drip emitters whereas it was more in the case of higher operating pressures.

4.2 Relative emitter discharge

Relative emitter discharge calculated for various treatments were plotted against different operating pressures, which is shown in Fig. 4.4 to Fig. 4.6

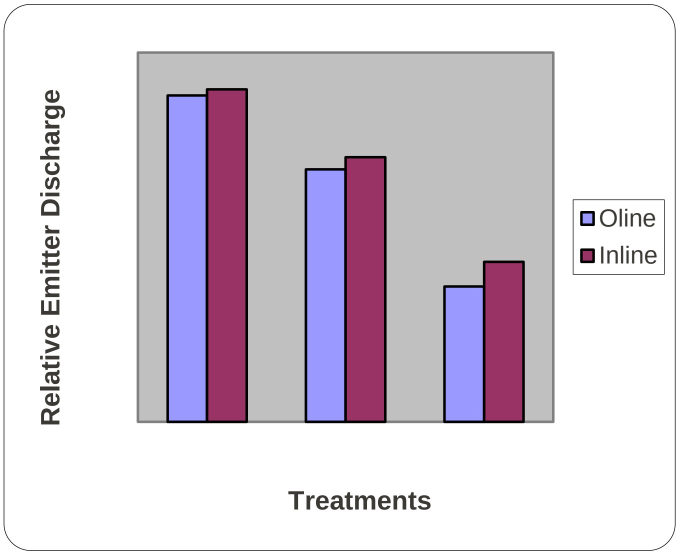


Fig.4.4 Relative Emitter Discharge at 0.6 kg/cm^2

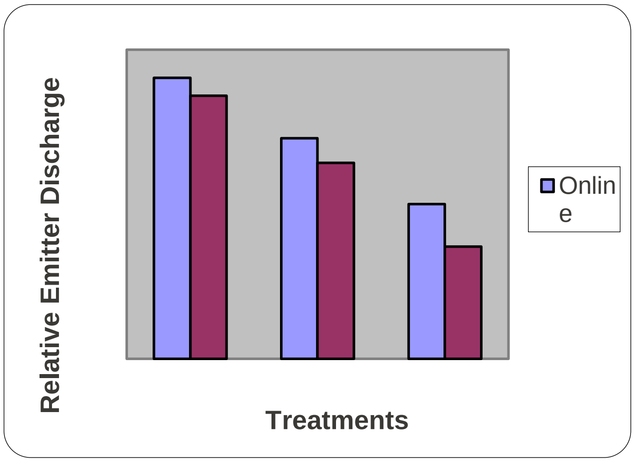


Fig.4.5 Relative Emitter Discharge at 0.8 kg/cm^2

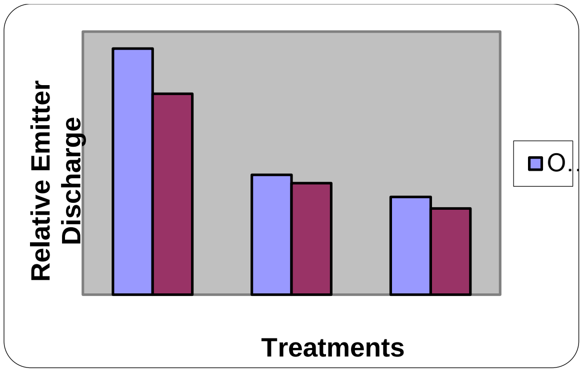


Fig:4.6 Relative Emitter Discharge at 1.0 kg/cm^2

From the graphs it is clear that Relative emitter discharge is more in the case of online drip emitters, at high pressures and a the same time under low pressure they will not work satisfactorily. On the other hand inline drip emitters gives more discharge than online under low pressure.

4.3 Reduction of mean discharge

Reduction of mean discharge calculated for various treatments are shown in Fig. 4.7 to 4.9

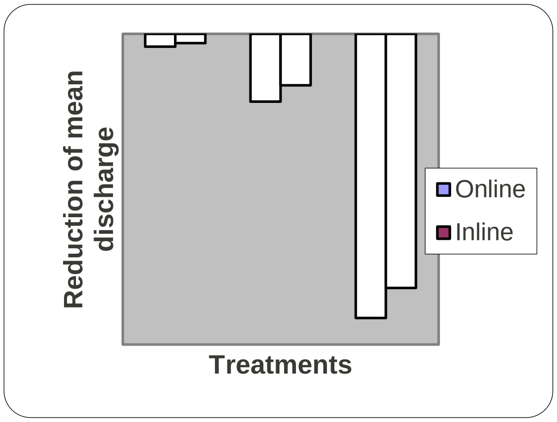


Fig. 4.7 Reduction of Mean Discharge at 0.6 kg/cm^2

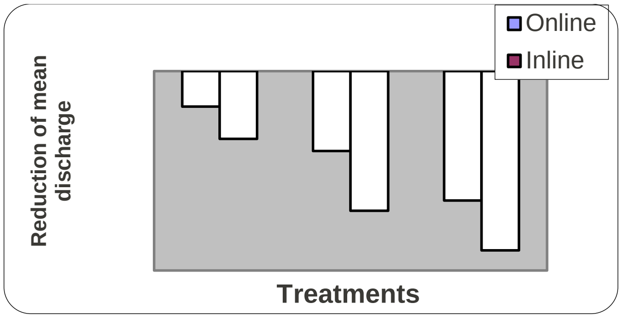


Fig. 4.8 Reduction of Mean Discharge at 0.8 kg/cm^2

Fig. 4.9 Reduction of Mean Discharge at 1.0 kg/cm^2

From the graphs it can be seen that mean discharge reduction is more in case of inline drip emitters at higher pressures and at lower pressure online drip emitter faces moe reduction in discharge rate.

4.4 Emission uniformity

Emission uniformity calculated for various treatments are shown in Fig. 4.10 to 4.12

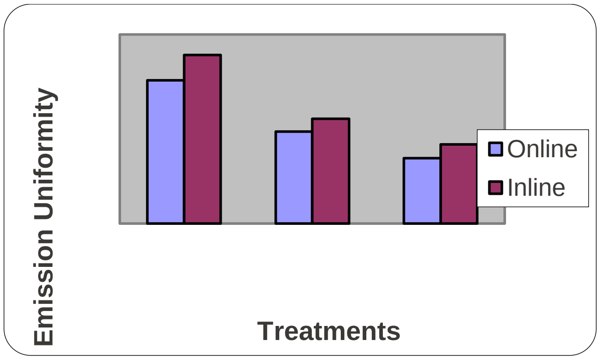


Fig. 4.10 Emission Uniformity at 0.6 kg/cm^2

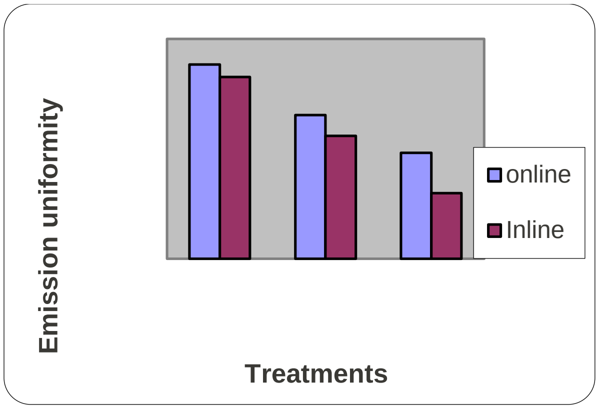
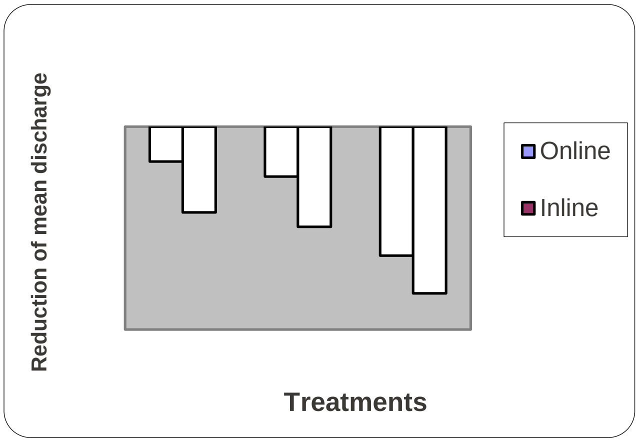


Fig. 4.11 Emission Uniformity at 0.8 kg/cm^2



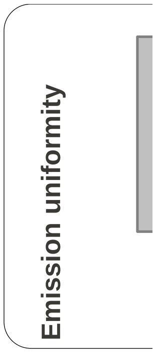


Fig. 4.12Emission Uniformity at 1.0 kg/cm^2

From the graphs it is clear that emission uniformity is more for online drip emitters at higher operating pressures and it is more for inline drip emitters at lower operating pressure.

4.5 Percentage of completely clogged emitters

Percentage of completely clogged emitters were worked out for all the treatments.

Plate.8. Clogged emitters

From the experiment it was seen that at 5% clay concentration, online drip emitters were not clogged, but 5% of inline drip emitters were completely clogged. Similarly at 10% concentration of clay only 5% of online drip emitters were clogged, whereas 25% of inline drip emitters were completely clogged.

Analysis of above parameters reveals that at higher operating pressures online drip emitters will work satisfactorily, with little percentage of clogging. At lower operating pressure online emitters will not work properly and inline drip emitters will work satisfactorily, but they are highly susceptible to clogging.

From the study it can be concluded that online drip emitters perform better than inline drip emitters under sufficient pressure head.

SUMMARY AND CONCLUSION

Drip irrigation has immense potential for water saving and irrigation management. It overcomes the drawbacks of surface methods of irrigation. It delivers water uniformly at the plant root zone through emission points with minimum water loss. Eventhough it has many advantages it faces many problems also. The main problem associated with drip irrigation is the clogging of emitters. Emitter clogging is caused by physical, chemical and biological factors. The common physical factors are suspended clay, silt and sand.

An attempt was made to study drip emitter clogging with the objective of comparing relative emitter discharge, reduction of mean discharge, emission uniformity and percentage of completely clogged emitters. Experiments were conducted at different concentration of clay viz. 5% and 10% and at different operating pressures viz. 0.6 kg/cm^2, 0.8 kg/cm^2 and 1 kg/cm^2 respectively.

Materials used for carrying out the experiment were inline and online drip emitters and fertigation tank to incorporate muddy water to the system. Initially emitters were treated with freshwater and discharges were measured. Comparison of discharges of inline and online drip emitters were done from the observed readings. After the first set of treatment emitters were supplied with muddy water of different concentrations viz. 5% and 10% respectively. Similarly discharges of both the emitters were measured and results were compared . The experiments were repeated at various operating pressures such as 0.6 kg/cm^2, 0.8 kg/cm^2 and 1 kg/cm^2 respectively.

The results obtained from the study reveals that online drip emitters perform better than inline drip emitters at higher operating pressures and inline drip emitters show better results against clogging at lower pressure. Relative emitter discharge is more in the case of online drip emitters, at high pressures and a the same time under low pressure they will not work satisfactorily.On the other hand inline drip emitters give more discharge than online under low pressure. The mean discharge reduction is more in case of inline drip emitters at higher pressures and at lower pressure online drip emitter faces moe reduction in discharge rate. Emission uniformity is more for online drip emitters at higher pressures and it is more for inline drip emitters at lower pressure. From the experiment it was seen that muddy water with 5% clay did not cause clogging of online drip emitters but 5% of inline drip emitters were completely clogged. Similarly muddy water with 10% concentration of clay caused clogging in 5% of online drip emitters, whereas 25% of inline drip emitters were completely clogged.

Analysis of above parameters reveals that at higher operating pressures online drip emitters will work satisfactorily, with little percentage of clogging. At lower operating pressure online emitters will not work properly and inline drip emitters will work satisfactorily but they are highly susceptible to clogging.

From the study it can be concluded that online drip emitters perform better than inline drip emitters under sufficient pressure head.

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