Published by :
http://www.ijert.org

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 12 Issue 10, October-2023

Improving Screen Filter Performance to Prevent Drip Emitters Clogging with Fish Farms Drainage

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Abstract— **Emitter clogging is a common problem in drip irrigation when irrigating with fish drainage, so efficient filtration is crucial to prevent emitter clogging. consequently, a screen filter was modified to improve its performance with fish drainage by installing pairs of arc iron blades inside the cartridge opposite each other alternately at an equal distances as follows: two and three pairs were installed at distances of 120 and 85 mm (filter 2 and filter 3) respectively. The performance of modified filters and traditional filter was assessed with fish drainage and ground water with two built in emitters. The total operating time was 160 hours over six months. The results revealed a reduction in relative discharge and uniformity coefficient with elapsed time for all treatments. Water type, filter model and emitter resulted in different relative discharge and uniformity coefficient decrease rates. Fish drainage has a greater negative effect on relative discharge and uniformity coefficient, and the presence of iron blades raised their values. The emitter 1 raised relative discharge and uniformity coefficient than emitter 2. Upon 160 h, the final relative discharge ranged from 70.2 to 88.2 % with fish drainage and from 80.0 to 89.2 % with ground water for treatments (traditional filter + emitter 2) and (filter 3 + emitter 1) respectively. Clogging ratio was classified slightly clogged except three treatments with fish drainage (traditional filter + emitter 1, traditional filter + emitter 2 and filter 2 + emitter 2) classified generally clogged. The uniformity coefficient decreased sharply with fish drainage and slowly with ground water, the highest and lowest values were 88.4 and 78.4% obtained by (ground water+ filter 3+ emitter 1) and (fish drainage + traditional filter + emitter 2) respectively. There was a positive relationship between relative discharge and uniformity coefficient since uniformity coefficient increased linearly with the degree of relative discharge. The correlation coefficient and slope of the regression equation for ground water was higher than those for fish drainage. Fish drainage has the highest head losses at various stages and reached the maximum allowable head loss faster than ground water. The iron blades reduced organic deposits in the filter output. The influence of iron blades on filter performance was more pronounced with fish drainage than ground water. In case of fish drainage, a 20-hour washing duration should be shortened by half.**

Keywords: Screen filter, emitter clogging, relative emitter discharge, uniformity coefficient.

I. INTRODUCTION

Emitter clogging is one of the most serious problems with drip irrigation systems, which caused by a single or combined result of chemical, biological, and physical factors and is directly related to the quality of the irrigation water and the design of the emitter flow path (Coelho and Resende 2001). Physical clogging is caused by suspended solids in irrigation water, while chemical clogging results from the deposition of one or more dissolved materials such as calcium, iron, or magnesium salts. Biological clogging also called biofouling is mainly due to the growth and accumulation of microorganisms such as algae, bacteria, and fungi in the emitter flow pathways. In drip irrigation systems, Suitable conditions can promote the rapid development of microorganisms leading to the buildup of slime and biofilm (Wu et al. 2004). Emitter clogging is associated with inappropriate filtration, an insufficient chemical balance of the applied water, irregular flushing, and inadequate monitoring of the hydraulic system performance (Lamm and Camp 2007). Occasionally, even with proper filtration, large amounts of deposits can accumulate in the emitters as a result of the collection and flocculating of tiny particles and ionic sediments (Niu et al. 2013). Over the last 20 years, with the rising adoption of treated waste water as an alternative source for irrigation, emitter clogging has become increasingly disturbing, and thus numerous studies have been performed aiming to help modern technologies to investigate the emitter clogging mechanism at the micro-scale when an alternative water source used (Hao et al. 2017; Pei et al. 2014; Song et al. 2017). Emitter clogging is not shown separately as physical, chemical, or biological clogging; they frequently interact and form composite clogging. The mechanism of this composite clogging is yet unclear. The anti-clogging performance is closely related to the type of emitter flow path (Li et al. 2013; Al-Muhammad et al. 2016; Feng et al. 2017). The emitter clogging is mainly related to the accumulation of substances at the inlet of the emitter, which closes the emitter

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 12 Issue 10, October-2023

flow path. Irrigation water source, emitter type, lateral placement (surface and subsurface), and emitter position on laterals (inline and online) all had a significant impact on emitter clogging. The pressure-compensating emitter is more resistant to clogging than the non-pressure-compensating one (Singh et al 2021). Recently, there are multiple new and innovative techniques to control the clogging; these techniques can generally be divided into two categories: preventive techniques and treatment techniques. Preventive techniques include installing filters, recurrent laterals flushing, etc. that prevent emitter clogging, and treatment techniques are those that attempt to remove sediments after they have accumulated on the emitter flow path (Shi et al 2022).

In arid and semi-arid parts of the world where water of high quality is scarce, reusing fish drainage for agriculture is considered one of the non-traditional alternative solutions. Because they rich in organic matter, fish drainage can increase soil quality, crop productivity and minimize fertilizer use (Ebong and Ebong, 2006). Drip irrigation is considered the most convenient irrigation system for reusing fish drainage in farm irrigation (Li et al., 2015; Pandey et al., 2010), but the main problem that hinders reusing the fish drainage in irrigation is that it contains a high percentage of sediments, which causes emitter clogging and so reduces the irrigation efficiency (Dazhuang et al 2009). When compared to traditional water fish drainage had a greater percentage of suspended materials such as algae and organic material which increase the emitter clogging ratio. The clogging ratio ranged from 7.9 to 19.3 % with traditional water while it ranged from 44.8 to 62.3 % with fish effluents (Eid and Hoballah 2014). Fish drainage caused a 15 - 20 % clogging ratio for the drip emitter; while the traditional water caused a 3.0 - 6.0 % clogging ratio (Attafy and Eid 2020). The majority of the suspended solids in fish effluents were organic sediments, which can be easily distorted and therefore removed from the emitter if they are not attached tightly (Manbari et al. 2020). Pressure-compensating emitters are preferred for working with fish drainage as they are less prone to clogging. As a management approach, drainage of the lateral lines at the end of each event had a substantial impact on the emitter's clogging rate (Maroufpoor et al. 2021).

Using the proper filtration unit is an effective strategy to prevent emitter clogging. Based on filtration method used, filters are classified into two categories, mechanical filters such as disc and screen filters, in which the filter pore diameters are smaller than the diameter of the particles that are suspended. In the second type sand filters and chemical and physical techniques are used in particulate removal (Ribeiro et al., 2008). Screen, disc, and sand filters are the most popular filters used in drip irrigation systems. Screen and disc filters are inexpensive and simple to use, while sand filters are complex, pricey, and best suited for high-tech farms (Tripathi et al., 2014). Using the sand filter alone with fish farm drainage water produced a very poor performance, which could be attributed to the kind of suspended solids and the particle size in fish effluents (Manbari et al. 2020), while the filtration efficiency increased when a sand filter followed by a disc filter (Wen-Yong et al. 2015) or followed by a screen filter (Hasani et al. 2023).

Therefore, the overall aim of this study was to improve the performance of screen filter in order to prevent the emitters clogging when using fish farm drainage water.

II. MATERIALS AND METHODS

A. *Experimental site and irrigation network*

The outdoor experiments were conducted at a private farm in Wadi El-Natroun Beheira Governorate, Egypt, which is located at 31˚ 30′ 35″ E longitude and 29˚ 52′ 31″ N latitude and mean altitude 6.7 m above sea level during the period from September 2021 to April 2022. The Central Laboratory for Agricultural Climate (CLAC) provided the climatic data including maximum and minimum air temperature (T_{mini} and T_{max}), relative humidity (RH), and wind speed (WS) for the experimental site as listed in Table (1).

Table 1. Climatic data for the experiment site

Month	T_{max}, °C	T_{mini}, °C	$T_{av.}$, °C	RH, %	WS, m/sec
Sept., 2021	36.5	21.5	29.0	53.6	3.1
Oct., 2021	32.2	18.5	25.4	56.9	2.7
Nov., 2021	28.3	15.8	22.0	63.9	2.2
Dec., 2021	19.9	10.0	15.0	69.2	2.7
Jan., 2022	17.3	6.4	11.9	68.4	2.6
Feb., 2022	19.8	7.3	13.5	67.3	2.5
Mar., 2022	21.8	8.0	14.9	57.9	3.0
Apr., 2022	32.3	13.5	22.9	46.3	3.2

The fish pond was built of concrete with 20 cm thickness and internal dimensions of 50 m length, 40 m width, and 5 m height. The Nile tilapia was added to the fish pond at a rate of 104 fry/fed. The commercial fodder during the breeding period contains crude protein 30 %, lipid 4.96 %, and crude fiber 5.08 % accounting for 10 % of fry weight. A submersible pump with 40 m^3/h discharge, a 110 mm backflow prevention valve, a pressure regulator, pressure gauges, a flow meter, and a 110 butterfly control valve made up the drip irrigation network. The piping system contains main line (Φ110HDPE pipe), manifold (Φ63HDPE pipe), screen filter, sub-main line (Φ50HDPE pipe), and lateral lines (Φ32LDPE pipe) with a 30 m length. The fish drainage was pumped into irrigation network using a centrifugal pump with a discharge 30 m^3/h discharge and the suction pipe was installed at a depth of 1.0 m from the bottom of the pond to prevent the withdrawal of sediment from the base. The water was pumped out from the fish pond three times a week, at a rate of 20% of the pond volume each time, and the pond was refilled in weekly bases. Samples of water were collected to run chemical analyses Table (2).

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International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
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TABLE 2. Some chemical properties of fish drainage and ground water under study

Parameter		Ground water, GW	Fish water, FW
PH		7.5	7.45
EC, ds/m		4.64	4.45
Cations, meq / L	Na^+	35.16	33.59
	K^+	1.14	1.12
	Ca^{+2}	13.32	12.72
	Mg^{+2}	2.55	2.42
Anions, meq / L	So_4^{-2}	22.71	22.00
	Cl^-	24.96	23.85
	Hco_3^-	4.5	4.00
	Co_3^{-2}	0.00	0.00
SAR		12.48	12.21
TDS^{-3}		7.60	7.40
No_3, mg/L		52.46	56.37

B. Screen filter specifications

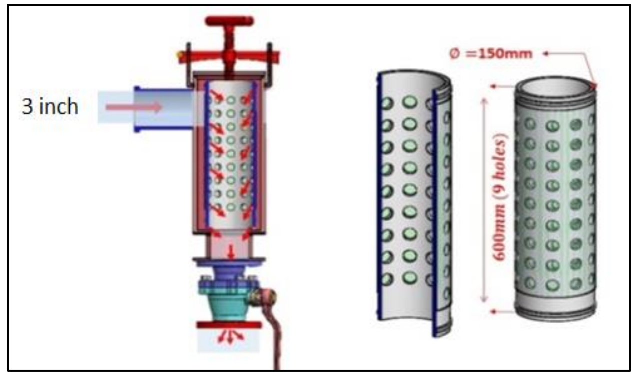
An iron screen filter with 220 mm external diameter and an inlet and outlet diameter of 63 mm was used in this study. The main filter cartridge consists of a PVC inner tube with 600 mm length, 150 mm inner diameter, and 10 mm thickness, the tube was perforated with holes diameter of 16 mm at regular distances of 60 mm and then was covered with a 120 nylon mesh. The theoretical discharge rate was 16 m^3 h^{-1} and filtration surface area was 0.320 m^2 as shown in Fig 1. During the filtration process, water enters from the inlet into the iron frame, then penetrates the nylon screen into the cartridge, where a high proportion of sediments are prevented by the nylon screen, and finally flows through the outlet into the irrigation network accompanied by fine sediments.

C. Study variables

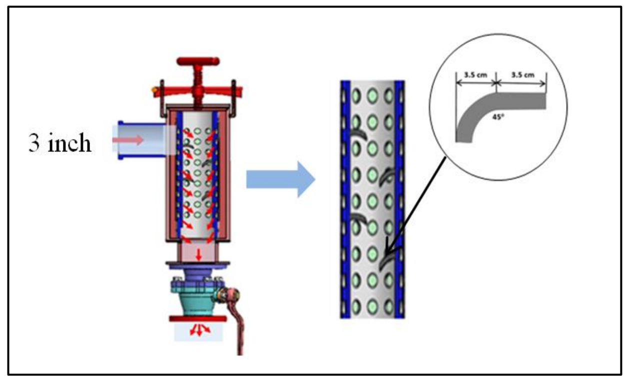
The study included three variables as follow:

1- Water type: two water types were used; ground water (GW) and fish drainage water (FW).

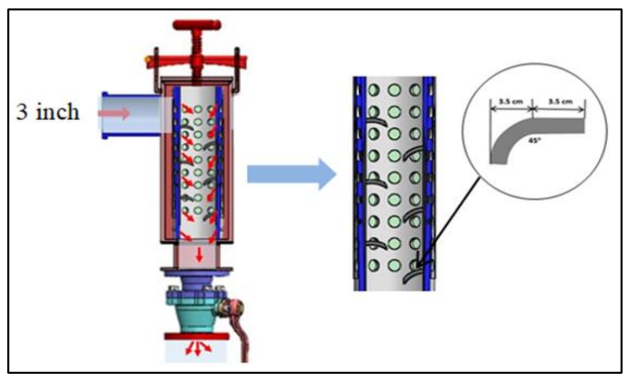
2- Screen filter: Three screen filter models which have the same theoretical discharge and same filtration surface area; traditional screen filter (model 1; TSF), and two modified screen filters: model 2 (MSF2) in which two pairs of arc iron blades of 70 mm long, 35 mm wide and 3 mm thick were installed in the cartridge opposite to each other alternately at equal distances of 120 mm, and model 3 (MSF3) in which three pairs of the same iron blades in model 2 are installed in the cartridge opposite to each other alternately at an equal distance of 85 mm. The three models are shown in Fig. 1. The working of modified models (MSF2 and MSF3) was based on the hypothesis that the hit of water accompanied by fine sediments that were not strongly prevented by the nylon screen with iron blades, breaking them into fine particles that are easily passed through the emitters, thus reducing the potential of emitter clogging



Model 1: TSF



Model 2: MSF2



Model 3: MSF3

Fig. 1. Screen filter models, model 1: traditional screen filter; TSF, model 2: modified screen filter 2; MSF2, and model 3: modified screen filter 3; MSF3

3- Emitters: Two types of built in emitters were used in this research study; the characteristics of the emitters are listed in Table 3. The nominal discharge rate was normalized at 100 kPa, the discharge were measured at different operating pressure values ranging from 50.0 to 400.0 kPa for E1 and from 50.0 to 250.0 kPa for E2. The relationship between the discharge rate and the operating pressure was described as a power function and the flow regime was classified according to (ASAE, 2003) as follows:

$$q = kP^x \text{ -------------------------- (1)}$$

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In which: q is the emitter discharge, l/h; P is operation pressure, kPa; *k* is the emitter discharge coefficient; and *x* is the emitter discharge exponent.

The manufacturer's coefficient of variation (MCV, %) for both emitters was calculated and classified according to (ASAE, 2003) as follows:

$$MCV = 100\frac{S_q}{q^-} \text{ --------------------- (2)}$$

In which: q^- is the average emitter discharge at 100 kPa, Lh^{-1}; and Sq is the standard deviation of the emitter discharge at 100 kPa, l/h.

Table 3. Specifications of the emitters used in the experiments

Emitter	Pipes shape	Emitter spacing, cm	D_e, mm	D_i, mm	PC	MCV, %	q_i, l/ h	Flow regime	Structure
E1	Round	30	16	14	PC	3.1 (Excellent)	4.0 (k = 3.79, x = 0.049)	Laminar flow	
E2	Flat	30	16	15.7	PC	3.2 (Excellent)	3.9 (k = 3.37, x = 0.173)	Laminar flow	

D_e: External diameter, D_i: Internal diameter, PC: Pressure compensating, q_i: Initial emitter discharge at 100 kPa

D. Experimental procedure

Irrigation lasted two hours per treatment, three times per week, for a total of 80 irrigation events divided into 8 stages totaling 160 hours over six months. The number of irrigations was determined depending on the typical scheduling in the region. At the end of each stage (10 irrigation events = 20 h), the cartridge for all filters was taken out and washed manually. Emitter discharge rates were measured along the emitter every stage.

E. Evaluation indicators:

At the end of each stage (20 hours), the following indicators were evaluated:

The temporal relative emitter discharge (q_r, %) and clogging ratio for each treatment were computed at the end of each estimating stage according to (Feng et al. 2018):

$$q_r = 100\, x\, ({}^{q_m}/_{q_i}) \text{ --------------- (3)}$$

$$CR = 1 - q_r \text{ -------------- (4)}$$

In which: q_m is the mean emitter discharge measured at the end of each stage (l/h), q_i is the mean initial emitter discharge (l/h), and *CR* is the clogging ratio of emitters, %.

The Christiansen uniformity coefficient (CU, %) was calculated according to (Christiansen 1942):

$$CU = 100\ (\ 1.0 - \frac{\sum_{i=1}^{n}|X_i - X^-|}{n\, X^-}) \text{ ------------ (5)}$$

In which: X_i is the measured discharge of the emitter i (l/h), X^- is the mean discharge in the lateral (l/h) and *n* is the total number of emitters investigated in each lateral.

The relationship between relative emitter discharge and Christiansen uniformity coefficient was estimated for the different treatments.

The head losses of the filters at every stage was measured and compared to maximum allowable head loss (50 kPa as mentioned by Hasani et al. 2023) to evaluate the impact of water type and filter type on pressure losses.

F. Statistical analysis

The results of twelve treatments (two water types, three models of screen filter and two emitters) were statistically analyzed with three replicates using split-split plot

design; the statistical analysis were performed using the Co-Stat software for Windows. The differences were compared using least significant difference test at a 0.05 significance level.

III. RESULTS AND DISCUSSION

A. The temporal relative emitter discharge

The temporal relative emitter discharge for two emitters with three filter models and two water types during the experiment period and standard error is shown in Fig. 2. The reduction in q_r with elapsed time was generally observed for all tested study parameters including water type, filter model and emitter which resulted in varied q_r descent rates in the tests. Ground water had a higher q_r value than fish farm drainage water, and the presence of iron blades enhanced q_r; E1 emitter had a higher q_r than E2. Complete discharge was observed at first stage of operation for the two emitters with MSF3 filter model and ground water, the reduction in relative emitter discharge with elapsed time for other treatments means relative emitter clogging was happened **(**Maroufpoor et al, 2021**).** at 40 hours of operation, the highest reduction in q_r for the two water types was noticed with a percent ranged from 4.6 % for (MSF3 + E1) treatment to 8.4 % for (TSF + E1) treatment with FW and ranged from 2.5 % for (MSF2 + E1 and MSF3 + E1) treatments to 4.4 % for (TSF + E2) treatment with GW. Upon completion of the experiment (160 h), the final q_r values vary depending on the study parameters. The values of q_r ranged from 70.2 to 88.2 % with FW and from 80.0 to 89.2 % with GW for the treatments (TSF + E2) and (MSF3 + E1), respectively. The results were in agreement with (Feng et al, 2017) where the q_r decreased to 50 % with saline groundwater and 70 % with fresh groundwater on 100 operation days. In contrast, the findings differed from those obtained by **(**Liu and Huang 2009), in which the emitter discharge remained greater than 95% for the reclaimed water. The main reason was that their drip system operated 12 hours per day for 120 h, whereas the tested system operated two hours three times a week for 160 h, so the total running hours were different, implying that, emitter clogging was affected not only by operating time but also by total using time, as expected.

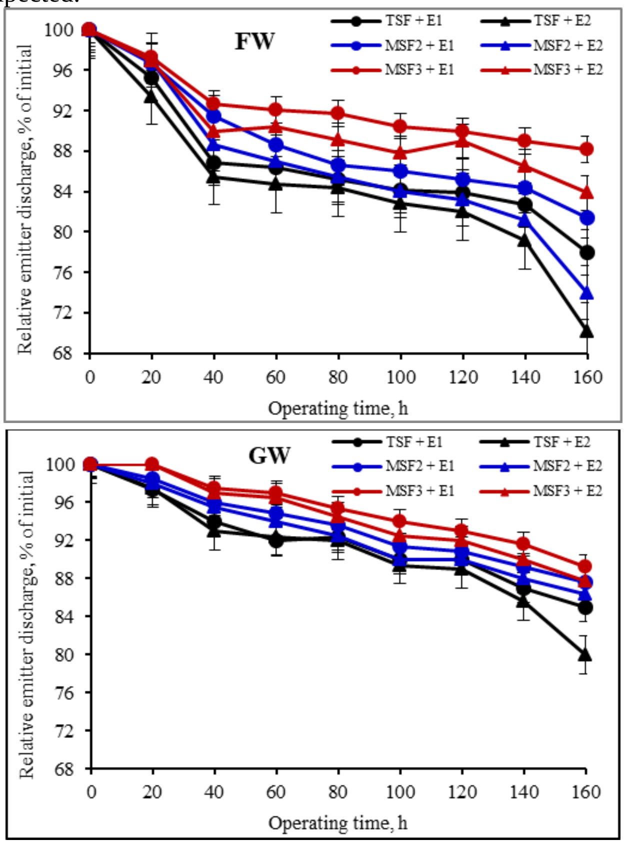

Fig. 2. Temporal relative emitter discharges and standard error for the tested emitters, different screen filter models and water types during the experimental period

At completion of the experiment (160 h operation time) the study parameters (water type, filter model and emitter) and the interaction between water type and emitter had a high significant effect on q_r as illustrated in Table 4. The comparison of means showed that the combination of GW, MSF3 filter model and E1 emitter had the highest effect on q_r, while the combination of FW, TSF filter model and E2 had the lowest one.

Table 4. Significance level of the study factors and the interaction for relative discharge, q_r and Christiansen uniformity coefficient, CU at completion of the experiment (160 h)

Factor and Interaction	q_r	CU
Water type (W)	**	*
Filter model (F)	**	**
Emitter (E)	**	**
W X F	ns	**
W X E	**	ns
F X E	ns	ns
W X F X E	ns	ns

ns: non-significant, * P< 0.05, ** P<0.01

Clogging ratio at operation time of 160 h and standard error is shown in Fig 3. In general, the increase in CR with elapsed time was observed for all treatments. Water type, filter model, and emitter all have impacted the CR. The results further demonstrated that FW had the highest CR values compared to GW. The presence of iron blades reduced CR and E1emitter had the lowest CR value compared to E2. According to (Wu et al. 2008), CR values were classified as slightly clogged (5-20%) for all treatments; with the exception of three treatments (TSF + E1, TSF + E2 and MSF2 + E2) with FW, where the clogging ratio was greater than 20% and characterized generally clogged. The highest CR value of 29.8 % was presented with FW under the treatment (TSF + E2), while the lowest CR value of 10.8 % was achieved with GW under the treatment (MSF3 + E1). The MSF3 filter model achieved the lowest CR percentage of 11.8% with FW using the E1 emitter, taking into account that there is no significant difference between it and the same treatment with groundwater.

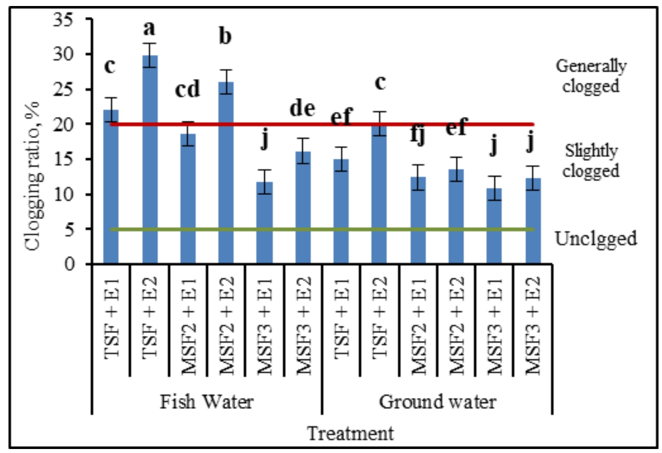

Fig. 3. Clogging ratio and standard error for different treatments at 160 h operation time

B. *Christiansen uniformity coefficient*

The changes in CU for the two tested emitters with three filter models and two water types during the experiment period are seen in Fig. 4. The initial CU for GW was higher than FW; generally there was a reduction in CU with elapsed time in all investigated treatments. Water type, filter model, and emitter all resulted in different CU decrease rates in the study. GW had a higher CU than FW, the presence of iron blades raised CU and the E1 emitter raised CU compared to E2. The CU with the FW treatments decreased sharply as the number of irrigation hours increased. In contrast, the CU in the GW treatments decreased slowly as the number of irrigation hours increased. These findings reveal that FW has a greater negative effect on the uniformity coefficient than GW. The same trend was also obtained by some previous studies (Liu and Huang 2009; Pei et al. 2014). The greatest reduction in CU occurred at 20 hours of operation with a percent ranged from 2.3 % for (MSF3 + E2) to 5.0 % for (TSF + E1) with FW and from 1.8 % for (MSF3 + E1) to 3.3 % for (TSF + E1) with GW.

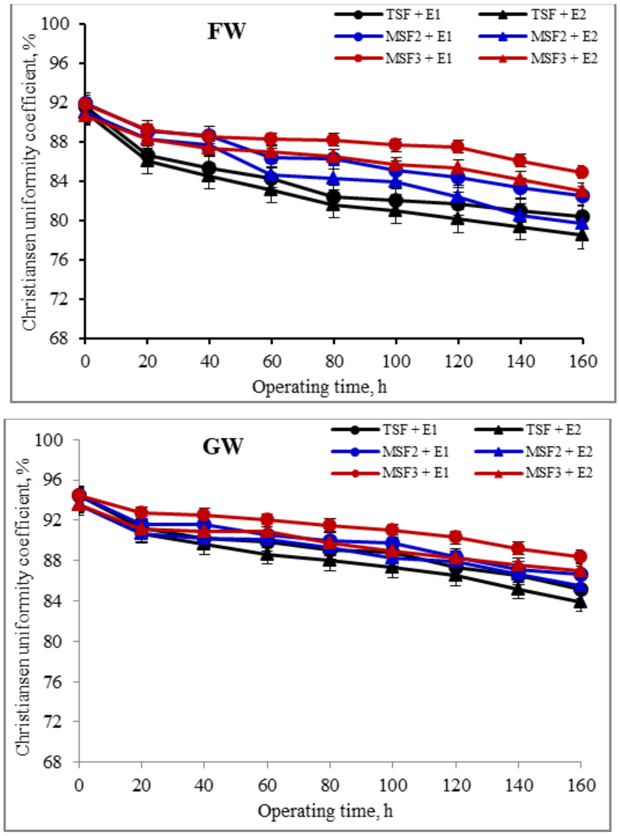

Fig. 4. Christiansen uniformity coefficient and standard error for the tested emitters at screen filter models and water types during the experimental period

Upon completion of the experiment (160 h operating hours) the study parameters (water type, filter model and emitter) and the interaction between water type and filter model had a high significant effect on CU as detailed in Table 4. The final CU values vary depending on the study parameters. The comparison of means showed that the combination (GW + MSF3 + E1) had the highest effect on CU with a value of 88.4 %, while the combination (FW + TSF + E2) had the lowest effect with a value of 78.4 % as depicted in Fig. 5. The MSF3 filter model enhanced CU compared to TSF by 5.6 and 5.9 % with FW and by 3.8 and 3.7 % with GW for E1 and E2 emitters, respectively.

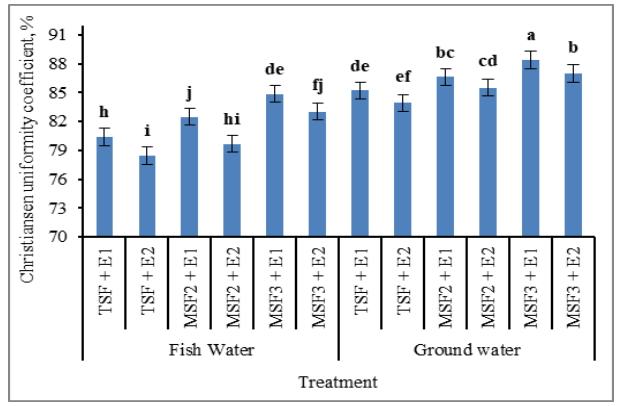

Fig. 5. Christiansen uniformity coefficient and standard error for different treatments at 160 h operation time

C. The relationship between q_r and CU

As shown in Fig. 6, there is a positive relationship between q_r and CU for different treatments as CU increased linearly with the degree of relative emitter discharge, as expected considering that relative emitter discharge and CU are indicators of emitter discharge uniformity (Feng et al. 2017). In addition, **(**Li and Chen 2009) tested six types of emitters using reclaimed water and underground water and observed that CU decreased linearly with the average degree of emitter clogging and also emitter clogging had a greater influence on CU for drip irrigation systems. Except for treatments (MSF3 + E2 and MSF2 + E1), the correlation coefficient (R^2) for GW was higher than that for FW; these discrepancies could be attributed to changes in water quality. The highest correlation (0.9464) between q_r and CU was achieved with FW which was found with the combination (MSF2 + E1), while the highest correlation (0.9452) with GW was found with the combination (TSF + E1). Except for the combination (TSF + E2), the slope of the regression equation for GW was greater than that for FW. With FW the maximum slope of regression equation (0.6554) was obtained with (TSF + E2), while the lowest slope of 0.4246 was obtained with (MSF3 + E2). In case of GW, the maximum slope of regression equation of 0.5672 was obtained with (TSF + E1) treatment, while the lowest slope of 0.4519 was obtained with (MSF3 + E2) treatment.

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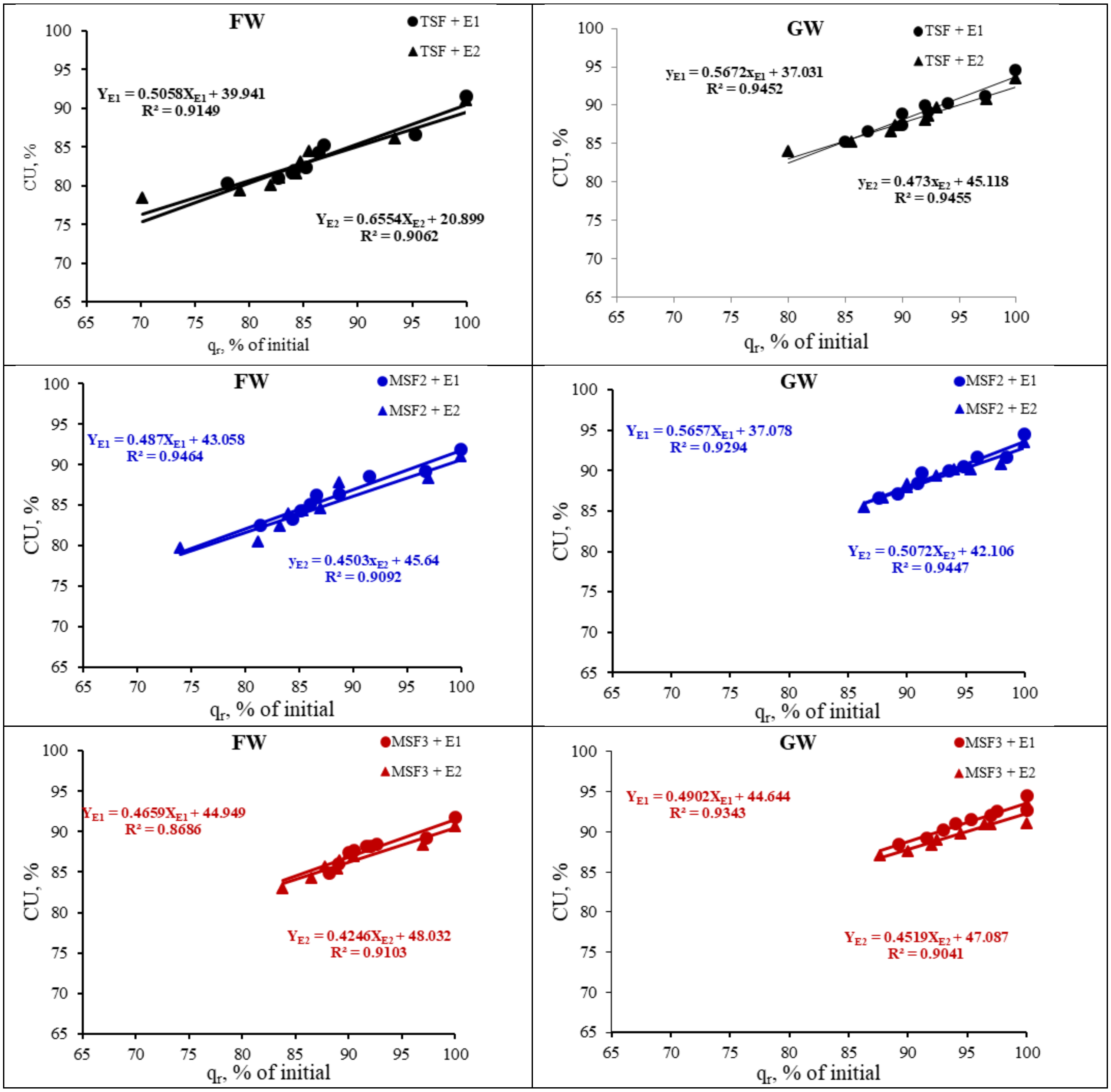

Fig. 6. Relationship between relative emitter discharge (q_r) and Christiansen uniformity coefficient (CU) for different treatments

D. Head loss of the filters at every stage

Fig. 7 displays the head losses for three filter models over eight experimental stages at an operating pressure of 230 kPa. The initial head losses of three filter models, TSF, MSF2 and MSF3, were 6.0, 7.0, and 9.0 kPa with FW and 6.0, 7.5, and 8.0 kPa with GW, respectively. Head losses for both water types increased with time; FW shows greater head losses at different stages of the experiment compared to GW. The highest head losses were found in both water types with TSF and the lowest values were observed with MSF3, indicating that the iron blades had no detrimental effects on head losses. In other words, the iron blades did not hinder the flow of water inside the filter. Furthermore, it aids in the reduction of organic deposits of the filter outlet. With FW, the head loss at 20 h before washing reached to 40.0, 35.0 and 27.0 kPa for TSF, MSF2 and MSF3, respectively; therefore, compared to TSF, the presence of iron blades reduced head loss before washing by 12.5 and 32.5 %; and after washing the head losses decreased to 8.0, 8.0 and 12.0 kPa for the three filter models, respectively. With GW the head loss at 20 h before and after washing was less than that with fish farm drainage water, reaching 25.0, 22.0 and 15.0 kPa before washing and 10.0, 7.0 and 5.0 kPa after washing for the three filter models respectively; consequently, MSF2 and MSFF3 reduced head losses by 12.0 and 40.0 % compared to TSF.

Pre-wash head loss increases with increasing duration of operating hours for both water types. After washing, the head loss with FW between 8.0 and 17.0 kPa for TSF, between 8.0 and 18.0 kPa for MSF2 and between 12.0 and 21.0 kPa for MSF3; likewise with GW the head loss ranged between 9.0 and 11.0 kPa for TSF, between 7.0 and 12.0 kPa for MSF2 and between 5.0 and 10.0 kPa for MSF3. For the three filter models, the FW reached the maximum allowable head loss of 50 kPa faster than the GW as follows: TSF at 80 h, MSF2 at 100 h and MSF3 at 120 h; similarly with GW, TSF and MSF2 at 140 h and MSF3 at 160 h. The results further revealed that the influence of iron blades on filter performance was more pronounced in FW than in case of GW. Whereas irrigation duration for each event was two hours, and the screen was washed every ten irrigation events (20 h), this washing period can be acceptable for ground water up to 120 h and should be shortened in half after that to prevent exceeding the maximum allowable head loss. With FW, a 20-hour washing duration is suitable for TSF up to 60 hours and for MSF2 and MSF3 up to 100 hours and should then be shortened by half.

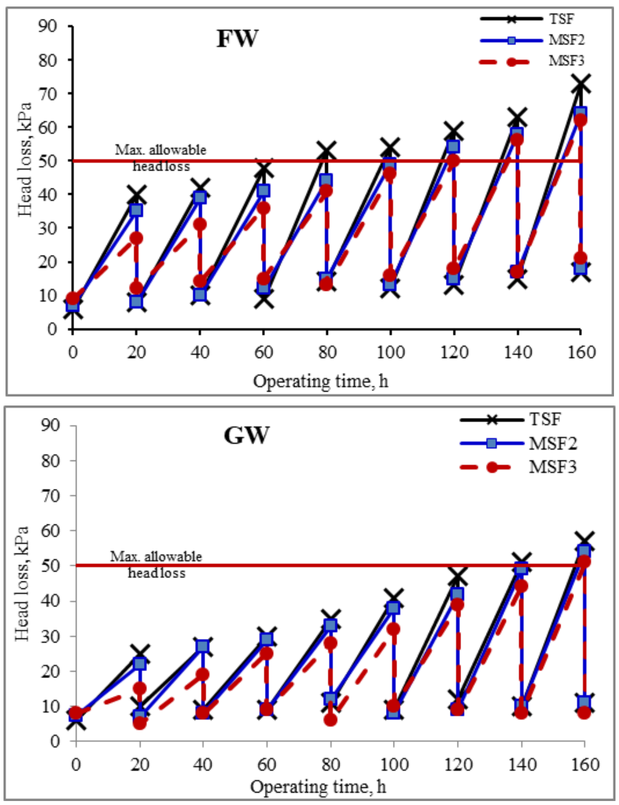

Fig. 7. Head loss of the three filter models at every stage with two water types

IV. CONCLUSIONS

This research study aimed to improve commonly used screen filter performance in order to avoid emitter clogging when using fish farm drainage water for irrigation. The study was based on the hypothesis that installing iron blades on the cartridge of the filter can enhance the performance of the filter. The results demonstrated that FW has a greater negative effect on q_r and CU than GW and the presence of iron blades raised q_r and CU values and E1emitter raised q_r and CU values than E2. FW raised clogging ratio than GW. FW sharply decreased CU in comparison to GW. There is a positive relationship between q_r and CU, where CU increased linearly with the degree of relative emitter discharge. FW raised head losses faster than GW at various stages of the experiment. The presence of iron blades helped in reducing organic deposits in the filter output. During working hours the head loss for FW was higher than GW. Iron blades had a greater impact on filter effectiveness in FW than in GW. With FW, a 20-hour washing duration must be shortened by half to avoid reaching to maximum allowable head loss. In conclusion, the performance of commonly used screen filter can be enhanced through changing the internal design of the filter (e.g. installing iron blades on the cartridge of the filter).

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International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 12 Issue 10, October-2023

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