HYDRAULIC PROCESSES IN IRRIGATION FLEXIBLE PIPES OF DRIP IRRIGATION SYSTEM AND RESULTS OF PRACTICAL STUDIES

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Abstract. *The article highlights the idea that, depending on the pressure in the irrigation pipes in the drip irrigation system, the correct distribution of consumption along the length of the pipe ensures the same development of agricultural crops. A practical study has been conducted on the distribution of pressure along the length of the fertilizer mixture in drip irrigation without and when it is added. As a result of field studies, it has been found that the counter irrigation method, which is widely used in traditional irrigation, can also be applied to drip irrigation, and it has been found that with this irrigation method, there is a possibility of reducing the waste of pressure along the length when applied to drip irrigation.*
Keywords: *drip, spend, pressure, counter, waste, length, irrigation.*

INTRODUCTION. There are various drip irrigation methods and technologies used in world agriculture, and their effective use requires the formation of complex technological processes. In particular, drippers, which are the main element of the system, are important in the effective operation of the Israeli drip irrigation technology. However, these drippers are made on the basis of complex technologies and require a large amount of money. In order to find economically acceptable solutions to this problem, inexpensive drippers are being used for irrigation farming in the Republic of Uzbekistan. However, the drip irrigation system is not as effective as the Israeli drip system, which in turn is a serious obstacle to the large-scale implementation of the drip irrigation system in irrigated agriculture in the Republic. The current problem has a serious negative impact on the efficient and reliable operation of drip irrigation system elements (water source, pressure-forming pump devices, pressure pipes that supply water to the crop field under pressure) [1]. Scientifically based analysis of hydraulic processes in the system is of great importance in ensuring the efficient operation of drip irrigation devices and system elements developed and used in the Republic, especially since irrigation pipes are made of flexible materials.

Research method. Piezometers were installed on the ground using a special device (pole) in the initial part connected from the irrigation pipe to the distribution pipe. Piezometers were installed on a pole so that their condition does not change due to external influences. To install the piezometer on the pole, the irrigation pipe was fixed using a distribution device (tee). The water distribution device has been installed on a 2.5 m high pipe, and a pressure piezometer has been attached to it and installed on the irrigation pipe.

To fasten the second piezometer to the flexible irrigation pipe, it has been carried out as above at a distance of 25 m from the first installed piezometer.

The third piezometer has been placed in the water distribution device based on the method of the established practical experience, the diameter of the piezometer is d = 15 mm and the length of the transparent pipe is L = 2 m. To install this piezometer in the irrigation pipeline, the first installed piezometer has been placed on the ground with a support at a distance of 50 m from the center. A 2.0 m high rail has been attached to the support, and in order to fix the piezometer to the irrigation pipe, a pipe has been cut in the place where the rail has been fixed, and a water distribution device has been installed on the flexible irrigation pipe. A transparent pipe with a diameter of d=15 mm has been inserted to install the piezometer on the water distribution device. A glass device with a diameter of d = 15 mm and a length of L = 0.70 m has been attached to it. Since the height of the piezometer have been 2 m, the glass burettes have been fixed to each other accordingly [5].

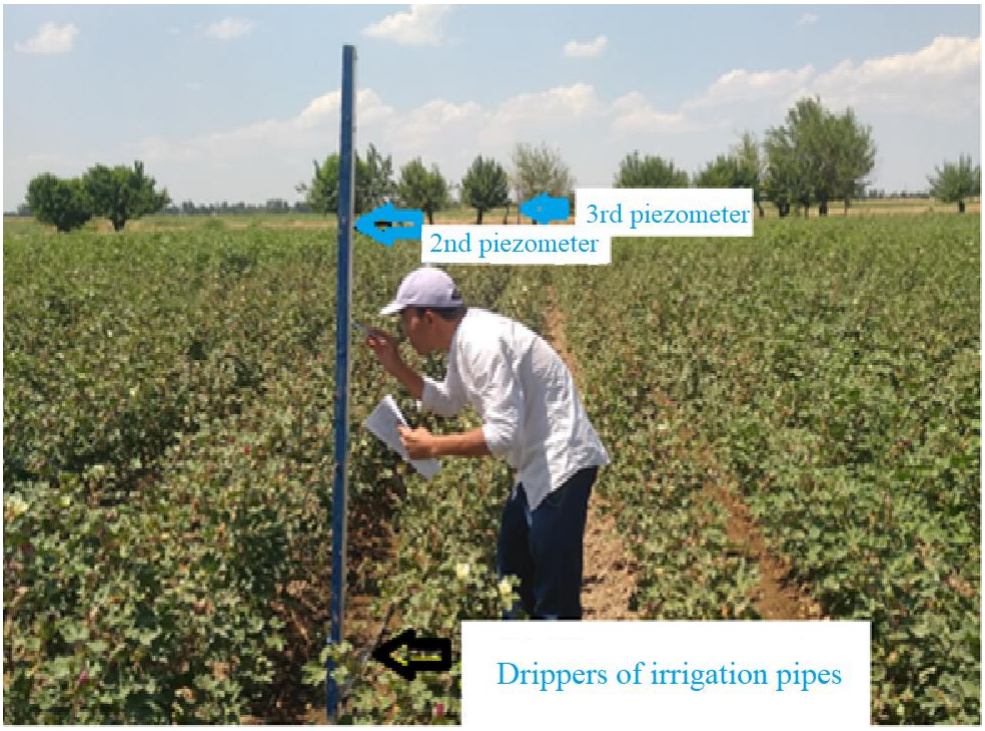

Figure 1. The process of placing piezometers in the field of practical experiment

To install the fourth piezometer, it has been fixed to the ground using a support (pile) at a distance of 75 m from the first piezometer. Installation of the fourth piezometer has been carried out in the same way as the third one.

Measuring process with piezometers in irrigation pipes installed in the distribution pipe when measuring pressure in piezometers installed in the drip irrigation pipe. In order for the water in the irrigation pipeline to stabilize, the upward movement of the water level in the second 25 m piezometer has been observed. When the water level has been observed in the third piezometer in the distance of 50 m from the first piezometer, it has been found that the level has also risen. When observing the fourth piezometer installed at a distance of 75 m from the first piezometer, it has been observed that the water level in the piezometer has not been rising, and the irrigation pipe has been connected to each other using an **adapter** (device). When the water pressure in the fourth piezometer part of the flexible irrigation pipe has been observed, it has been found that there is an effect of water pressure from the opposite side.

During the research, the water inlet to the pipe part where the fourth piezometer is located in the flexible irrigation pipe has been temporarily closed, and the study of the change of pressure waste along the length of the irrigation pipe has been carried out as follows (Fig. 1).

In order to fix the digital manometer to the distribution pipe for the hydraulic analysis of the processes in the distribution pipe, the crane has been installed in the place where the distributor, i.e., the lifelet pipe, is installed in the irrigation pipe.

Since the installed digital manometer has the ability to measure in 7 indicators, the unit of measurement has been changed to bar. The indicators of the installed digital manometer have been defined, several of their indicators have been determined, and the average of these indicators has been accepted [2].

Discussion and results. Based on the method adopted in the framework of the dissertation, the practical scientific-experimental research operations have been repeated 4 times. This flow (Fig. 1) is reflected in the graph.

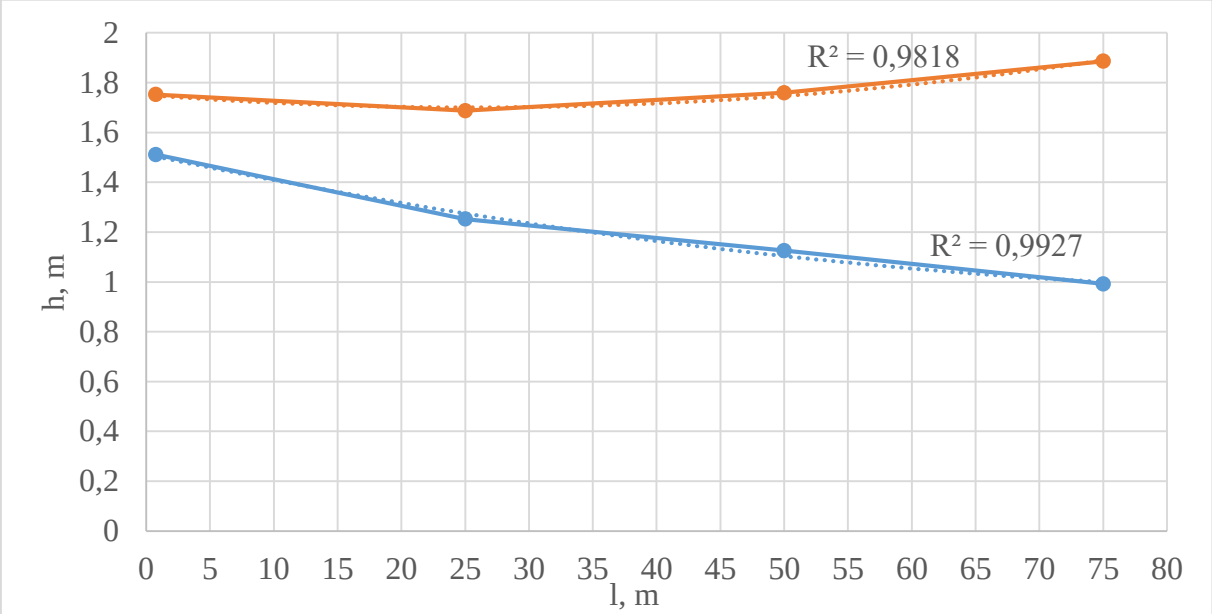

Figure 2. Variation of pressure loss along the length of the irrigation pipe when water is sent to the drip irrigation system in one and two directions without adding fertilizer mixture to the water

As a result of practical research, it has been determined that the initial pressure of a 75 m long drip irrigation pipe is 1.5115 m, and the pressure loss is equal to 0.5193 m in line 2 of Figure 1.

The conducted studies have been re-measured 5 times, and based on the analysis of the results of the 2nd line of Figure 2, the following expression has been obtained to determine the waste of pressure of the drip irrigation system along the length of the pipes [5]:

$$h = 5 \cdot e^{-5} \cdot l^2 - 0{,}0108 \cdot l + 1{,}512 \qquad (1)$$

The results have been obtained by sending water one-way to the irrigation flexible pipe according to the specified method of practical research.

Practical scientific-experimental research operations have been repeated 4 times and the average value has been taken for their results and reflected in the graph in line 1 of (Fig. 2).

In practical studies, it has been determined when two-way water is sent to a drip irrigation pipe with a length of 75 m, the initial pressure is 1.7524 m and its waste is equal to + 0.1332 m [3].

When two-way water is sent to the irrigation pipe, the waste of pressure in the irrigation pipe is more than compensated by the water supplied from the second side. This flow is expressed in (2) based on the analysis of line 1 of Figure 2

$$h = 8 \cdot e^{-5} \cdot l^2 - 0{,}004 \cdot l + 1{,}7508 \quad (2),$$

With the help of expressions (1, 2), the pressure in the drip irrigation pipes has been re-measured 5 times to determine the optimal length that does not increase the waste of water pressure.

The average pressure values obtained based on the analysis of the indicators determined in the manometers (Fig. 3) are shown in the graph.

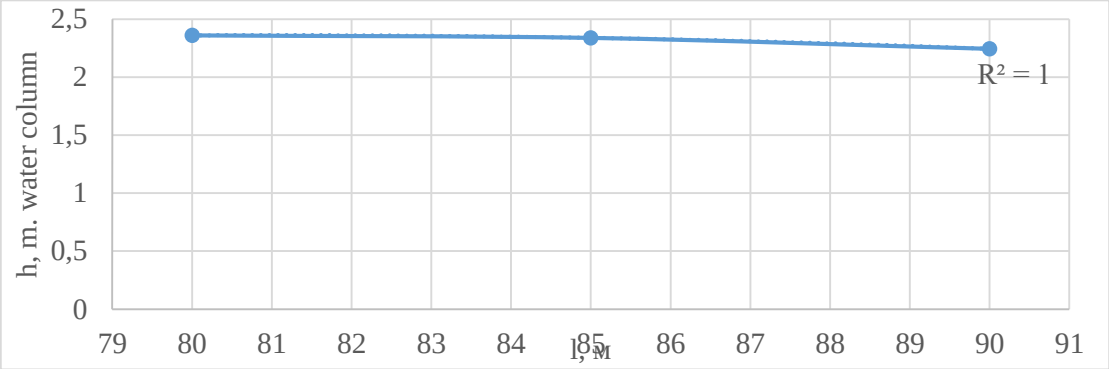

Figure 3. Longitudinal pressure variation in the distribution pipe of a drip irrigation system without the addition of a fertilizer mixture to the water

A distribution pipe 10 m long has an initial pressure of 2.3606 m of water column and a pressure loss of 0.1157 m of water column.

$$h = 0{,}005 \cdot l^2 + 0{,}2352 \cdot l - 7{,}1635 \quad (3)$$

A study has been conducted when a fertilizer mixture has been added to a drip irrigation system.

The indicators obtained based on the results of the research have been added together and averaged, and they are shown in the graph below (Figure 4).

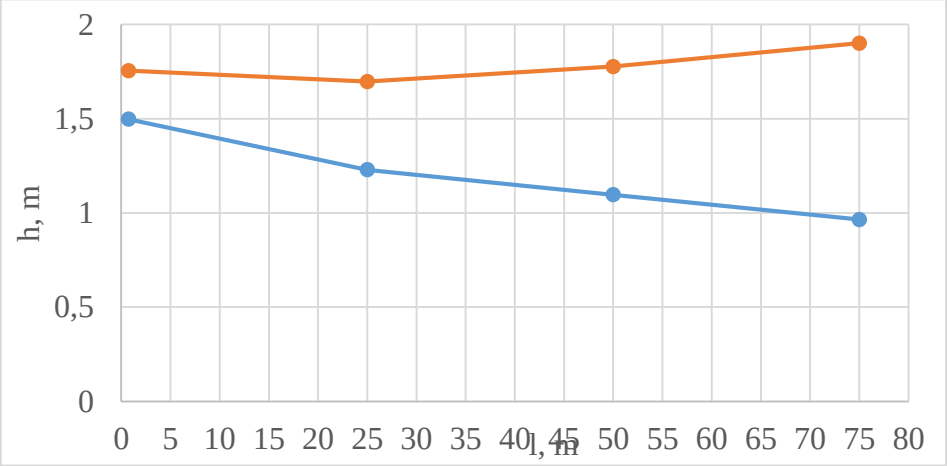

Figure 4. Waste of pressure in the opposite and one-way movement of water and fertilizer mixture in the drip irrigation system

In the two-way flow of water to a drip irrigation pipe of 75 m long, the initial pressure in it is 1.7545 m, the pressure loss is equal to + 0.1465 m. When two-way water movement has been formed in the irrigation pipe, the waste of pressure in the irrigation pipe has been more than compensated by the effect of water pressure from the other side.

The following expression has been obtained based on the analysis of the results of practical studies, line 2 of Figure 4.

$$h = -1 \cdot e^{-6} \cdot l^3 + 0{,}0002 \cdot l^2 - 0{,}00067 \cdot l + 1{,}7594 \qquad (4)$$

The pressure indicators in the piezometers have been determined 5 times and the average value of the results has been obtained and they are shown in the graph below (Fig. 4).

The length of the drip irrigation pipe is 75 m, the initial pressure is 1.4969, and the pressure loss in the drip irrigation pipe is 0.5324 m.

$$h = -2 \cdot e^{-6} \cdot l^3 + 0{,}0002 \cdot l^2 - 0{,}0161 \cdot l + 1{,}5089 \qquad (5)$$

(4 and 5) have been used to determine the optimal length of the drip irrigation pipes that does not increase the waste of pressure in the movement of water and fertilizer mixture.

The manometer indicators of the water in the distribution pipe are taken in **bar**, they have been converted to water column measurement m.

The average pressure indicators obtained based on the analysis of the indicators determined in the manometers (Fig. 5) are shown in the graph.

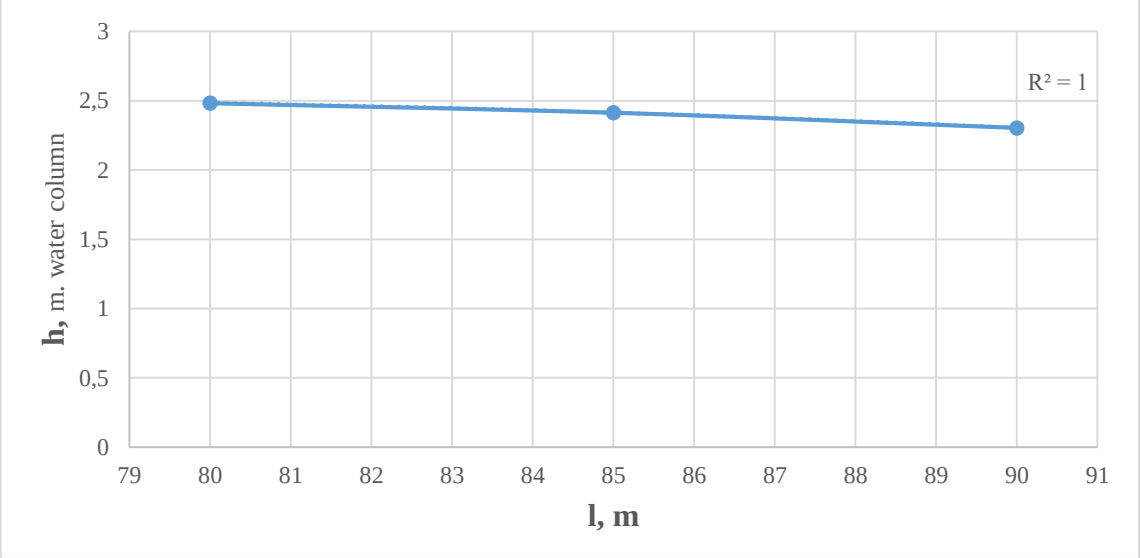

Figure 5. Variation of pressure along the length of the movement of the water and fertilizer mixture in the distribution pipe of the drip irrigation system

It has been determined that the pressure at the beginning of the distribution pipe at a distance of 10 m is equal to 2.4830 m of water column, the waste of pressure in the distribution pipe is equal to 0.1790 m of water column, based on which the following expression has been formed [4].

$$h = 0{,}001l^2 + 0{,}121l - 1{,}96 \qquad (6)$$

The expression (6) makes it possible to determine the waste of water pressure along the length of the drip irrigation pipe.

Conclusion

Until the distribution of pressure in the pipes of the drip irrigation system is achieved, it is not possible to evenly distribute water consumption during irrigation of agricultural plants through drip irrigation, as a result, the development of agricultural products does not develop evenly and does not yield high yields.

It has been found as a result of practical studies that in the study where water has been sent one-way to the pipe with fertilizer mixture in the drip irrigation pipeline, the pressure has been reduced compared to the first study. When the water with fertilizer mixture has been sent from two (counter) sides to the irrigation pipe, the water pressure has increased compared to our first study.

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