

DETERMINATION OF HYDRAULICALLY ACCEPTABLE LENGTH OF DRIP IRRIGATION PIPE

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Abstract. Practical studies were carried out to determine the optimal length of the pipe in drip irrigation with and without fertilizer mixture at different slopes and at different pressures. When determining the optimal lengths of irrigation pipes $i=0,0$ at different pressures and slopes: $i=-0,004555$; $-0,00613$; $0,00288$; $0,00235$; $0,00228$ $0,000497$; diameter $d=16$ mm, droppers 50,40,30 sm research was conducted to determine the dependence of the length of the pipe on the pressure and consumption of the water and fertilizer mixture. Based on the results of the research, the results of the research aimed at determining the optimal length of the pipes are presented in this article.

Keywords: consumption, pressure, process, drippers, pipe, diameter, slope, fertilizer, mixture.

Introduction. According to scientific and practical analysis, under the influence of climatic changes observed on our planet, the water shortage, the seriousness of the economy, threatens to create serious problems in the areas related to irrigated agriculture.

In recent years, the problems related to water resources in the republic are becoming serious day by day, and it has a serious negative impact on the formation of river water resources on a regional and global scale. Effective use of existing water resources, use of drip irrigation technology in accelerating the gradual transition from traditional irrigation methods to water-saving technologies is becoming one of the most urgent problems [1].

In order to solve these problems, scientific and practical studies were conducted to determine the hydraulically acceptable length of the drip irrigation technology irrigation pipe.

Problem issue. The studies to determine the optimal length of the drip irrigation pipe were adapted to the drip irrigation system to measure the pressure in the irrigation system using high-precision digital manometers, field studies were conducted and the results were analyzed. Determining the optimal length of flexible drip irrigation pipes with a diameter of 30, 40, 50 cm with cylindrical and solid flat drippers of \varnothing 16 mm, depending on the consumption and pressure of movement of the drip irrigation pipe with and without fertilizer mixture in water.

Diameter \varnothing 16 mm dropper spacing 50 cm. A pressure loss study of a drip irrigation flexible pipe in the horizontal ($i=0,0$) case was carried out on a drip irrigation plot in the IWPSRI area. An irrigation pipe with a length of 193 m was installed in the experimental field, and a special device (its slope is unchanged $i=0$) was formed on the field in a horizontal ($i=0,0$) position according to the research method [2].

Discussion and results. Analysis of the pressure change process along the length of the irrigation pipeline at the pressures determined based on the average indicators of manometers installed at 193 m of the length of the flexible irrigation pipeline was carried out according to the parameters listed in Table 1.

Table 1

Manufacturer	The location of the graph in the picture and the type of dropper	Dropper spacing, sm	Length and initial distance, m	Manometer pointer at 1.5 m, m. in the water column	Longitudinal pressure loss in 193, m. in the water column
“Agro Drip”	Row 1, cylindrical	50	193; 1,5	21,0389	17,2692

Based on the indicators obtained from the digital manometer in the irrigation pipe, the dependence of the pressure loss on the length of the pipe was investigated and their results were graphically analyzed in (Fig. 1).

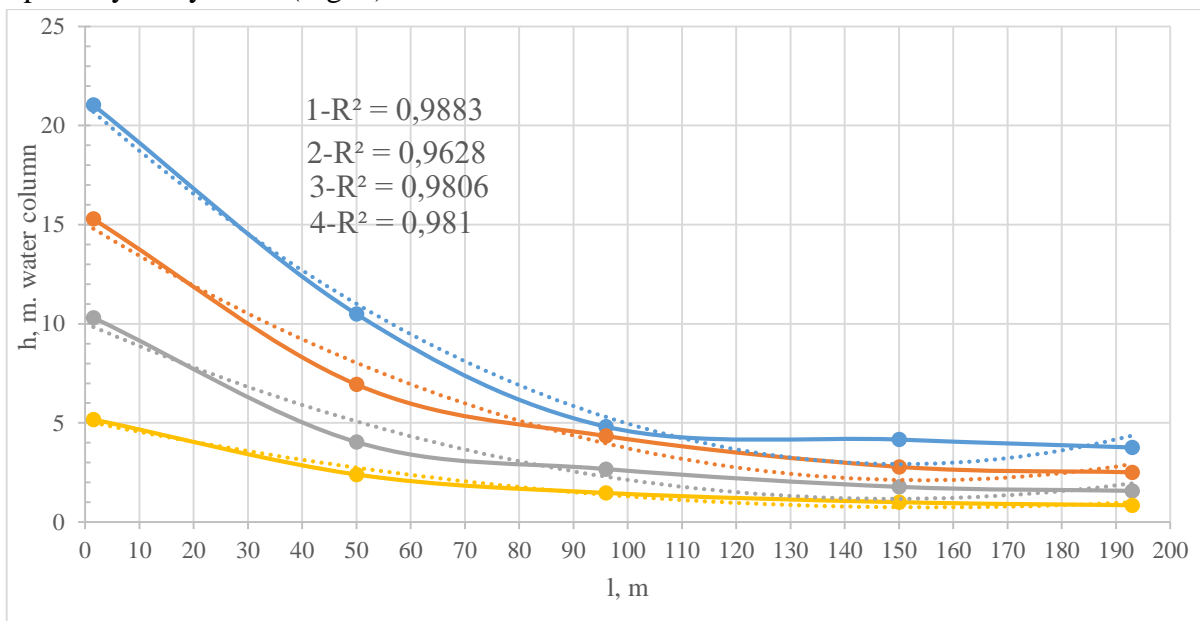


Fig.1. Generalized variation of pressure loss in a flexible drip irrigation pipe.

Based on the analysis of lines 1, 2, 3, 4 of the results of practical research in the graph (Fig. 1), expressions are obtained and their characteristics are as follows:

$$h = 0,0008 \cdot l^2 - 0,2409 \cdot l + 21,055 \quad (1)$$

(1) - the expression made it possible to determine the waste of water pressure (h) according to the length (l) of the drip irrigation pipe.

The length of the flexible drip irrigation pipe is 70 m. in 5 repetitions, practical studies were carried out to determine the optimal length of the irrigation pipe and waste of pressure.

The analysis of the pressure change process along the length of the irrigation pipeline based on the pressures determined on the basis of the average readings of the manometers installed in the initial part of the flexible irrigation pipeline and at 70 m of its length is presented in Table 2.

Table 2

Manufacturer	The location of the graph in the picture and the type of dropper	Dropper spacing, sm	Length and initial distance, m	Manometer pointer m. in the water column	Longitudinal pressure loss in 70, m. in the water column

“Agro Drip”	Row 1, cylindrical	50	70; 1,5	23,2597	3,0686
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Based on the pressure readings on the manometer, the waste of pressure in the irrigation pipeline along the generalized length and determination of the optimal length of the pipeline are presented in the graph:

Based on the indicators obtained from the digital manometer in the irrigation pipe, the dependence of the pressure loss on the length of the pipe was investigated and their results were expressed in a graph (Fig. 2).

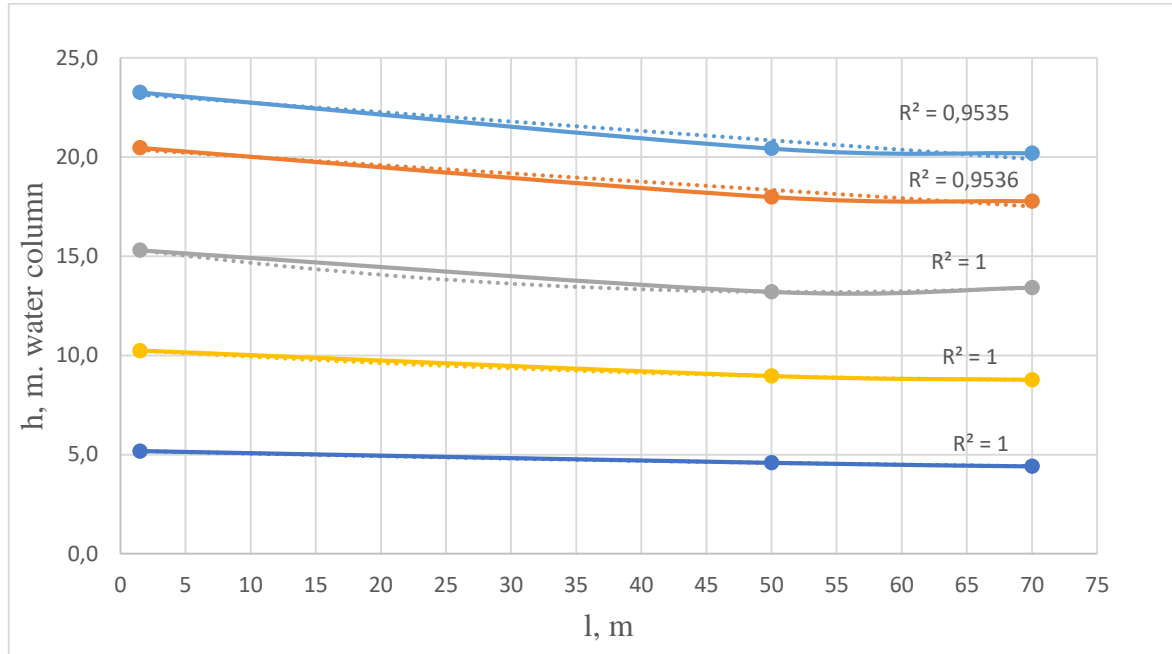


Fig.2. A graph comparing the generalized case of waste at varying pressures in a drip irrigation flexible pipe.

The expressions for lines 1, 2, 3, 4, 5 of Fig. 2 obtained on the basis of the results of practical research are taken and their characteristics are as follows [3].

$$h = 0,0007 \cdot l^2 - 0,0931 \cdot l + 23,398 \quad (2)$$

Expression (2) makes it possible to determine the waste of water pressure along the length of the drip irrigation pipe.

Table 3

Manufacturer	The location of the graph in the picture and the type of dropper	Dropper spacing, sm	Pipe length and manometer installed distance, m	Manometer pointer m. in the water column	Longitudinal consumption distribution indicator l/ hour
“Agro Drip”	Row 1, solid flat	40	150; 1,5	3,18	1,95
“Netafim”	Row 1, cylindrical	50	150; 1,5	2,23	1,82

Practical studies of water consumption of cylindrical and solid flat drippers in the horizontal (i=0) state of the drip irrigation pipe were conducted based on the parameters listed in Table 3, and the results are graphically analyzed in Figure 3.

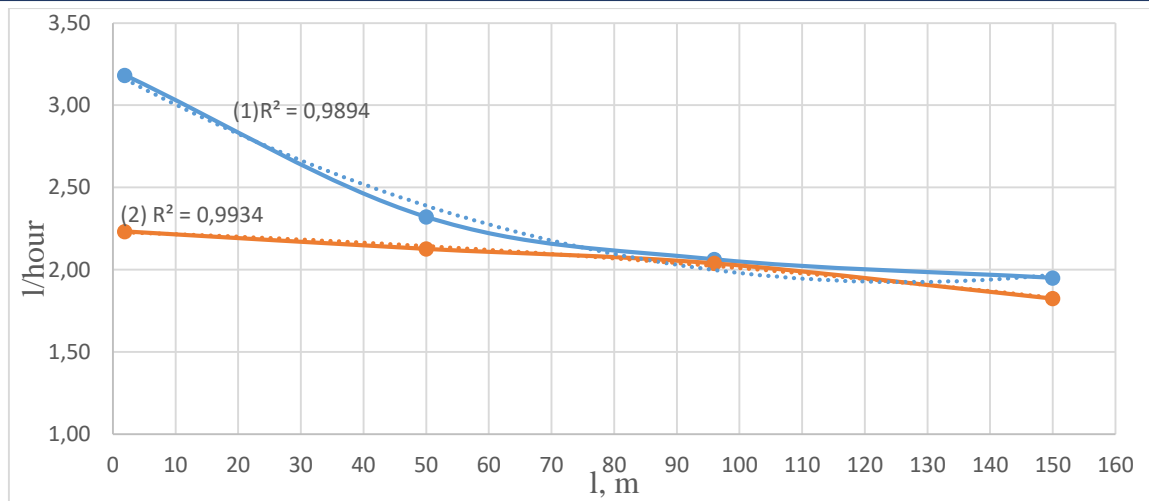


Fig.3. The length of the pipe is 150 m. Water consumption of cylindrical and solid flat drippers in horizontal position (i=0).

A comparison of the results obtained on the water consumption of drippers in 150 m. long horizontal cylindrical and solid flat drip irrigation pipes is presented in the graphs in Figure 3:

Expression (4) was obtained based on the analysis of the results of practical studies, Fig.

3, line 2.

$$q = 9e^{-6} \cdot l^2 - 0,0012 \cdot l + 2,2292 \quad (4)$$

Expression (4) allows determining the change of water consumption along the length of the drip irrigation pipe.

Depending on the slope of the land, the distance between the drippers in the case of no fertilizer mixture and different slopes is 50 cm. pressure variation in an irrigation pipe with a diameter of Ø 16 mm.

Table 4

Manufacturer	The slope of the study and the type of dropper	Pipe diameter Ø and dropper spacing		Length and initial distance, m	Manometer pointer at 0.2 m., in the water column	Pressure loss along the length, m. in the water column
		sm	mm			
"Agro Drip"	i=-0.00455 cylinder	50	16	193; 0,20	20,8877	17,088
	i= 0.00235 cylinder	50		80; 0,20	23,6818	4,3076

The horizontal drip irrigation pipe of the companies "Agro Drip" and "Netafim" has a diameter of Ø 16 mm, a length of 150 m with cylindrical and solid flat drippers, the distance between the drippers of the drip irrigation pipe is 50 and 40 cm. done.

The length of the irrigation pipe is 150 m at 1.90 m from the distribution pipe. per 50.0; 96.0; and 150.0; m. distance dropper water consumption measurement was carried out by volumetric method. In this method, the capacity is 1.0 l. a **measuring cup** (beaker) and a stopwatch were used to measure time.

The optimal length of the pipe was determined based on the comparison of consumption indicators in the graph of the results obtained in the graph (Fig. 4).

Depending on the slope of the land, the diameter of the drip irrigation pipes is \varnothing 16 mm, and the distance between the drippers is 50, 40 and 30 cm. in order to determine the wasted pressure consumption along the length of flexible drip irrigation pipes with cylindrical and rigid flat drippers, the readings obtained from digital manometers at the specified locations of the irrigation pipe were compared:

One of them is $i=-0.00613$ in the position depending on the slope of the land at 150 m, comparing the results obtained in cylindrical and solid flat irrigation pipes (Fig. 4):

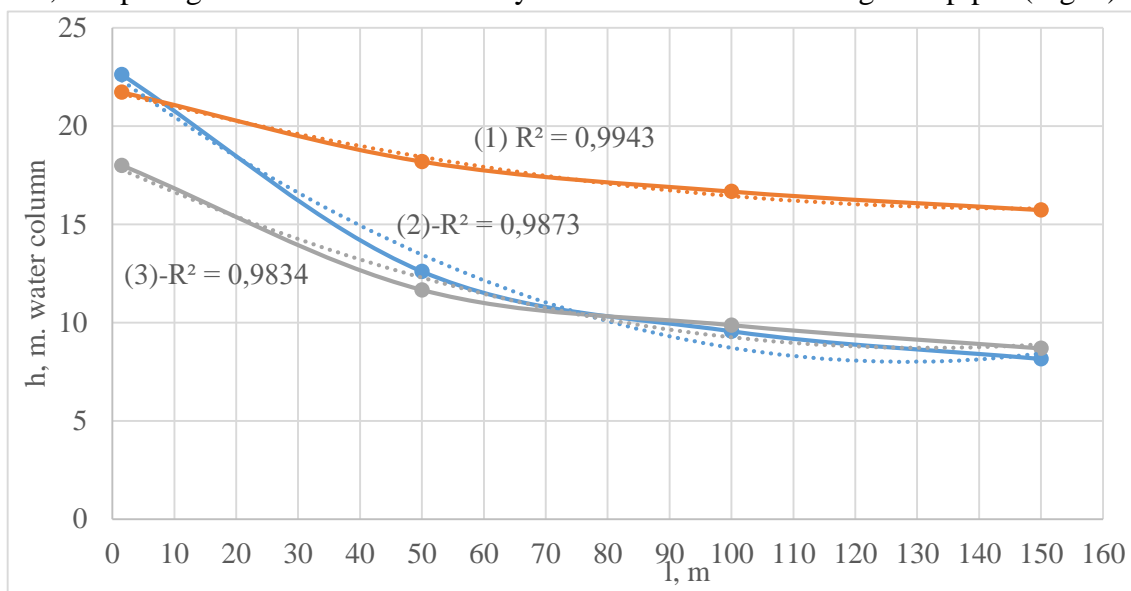


Fig. 4. The length of the pipe is 150 m. Analysis of the change of water pressure waste on the length of the irrigation pipe with cylindrical and solid flat drippers in case of slope ($i=-0.00613$).

Expression (6) was obtained based on the analysis of the results of practical studies, line 1 of Figure 4 [7].

$$h = 0,0003 \cdot l^2 - 0,0802 \cdot l + 21,756 \quad (6)$$

It depends on the slope of the land and the distance between the drippers in the case of no fertilizer mixture and different slopes is 50 cm. pressure variation in an irrigation pipe with a diameter of \varnothing 16 mm.

Table 5

Manufacturer	The slope of the study and the type of dropper	Pipe diameter \varnothing and dropper spacing		Length and initial distance, m	Manometer pointer at 0.2 m., m. in the water column	Pressure loss along the length, m. in the water column
		CM	MM			
"Agro Drip"	$i=-0.00455$ cylinder	50	16	193; 0,20	20,8877	17,088
	$i= 0,00235$ cylinder	50		80; 0,20	23,6818	4,3076

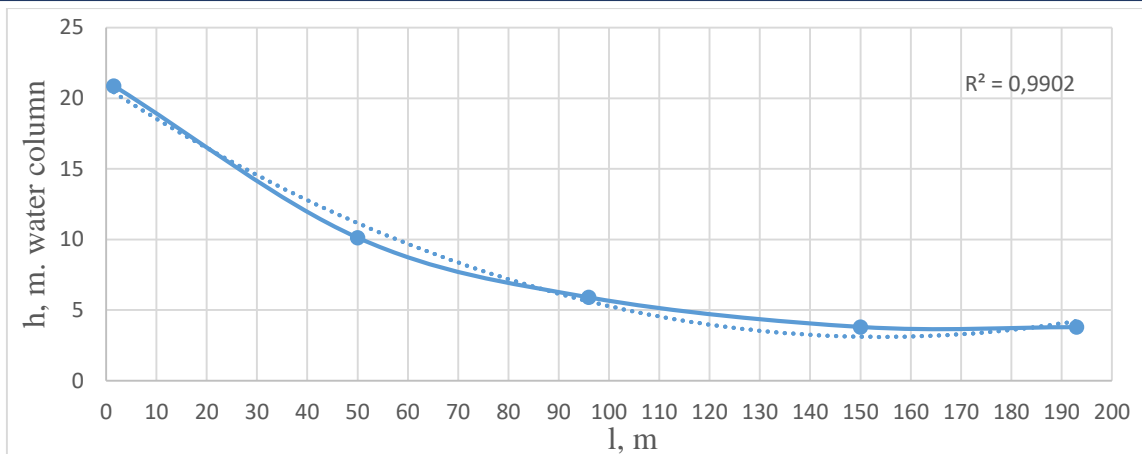


Fig. 5. Variation of wasted pressure consumption along the length of the irrigation pipe (when $i=-0.00455$) in the case of no fertilizer mixture

Based on the analysis of the results of practical studies, the expression (7) was obtained on the basis of Figure 5 (graph).

$$h = 0,0007 \cdot l^2 - 0,2292 \cdot l + 20,766 \quad (7)$$

Expression (7) allows to determine the waste of water pressure along the length of the drip irrigation pipe.

Depending on the slope of the land and the addition of fertilizer mixture, the distance between the drippers is 50 cm. the length of the flexible drip irrigation pipe with a diameter of \varnothing 16 mm is 193, 100, 80 m. the results of the research.

Table 6

Manufacturer	The slope of the study and the type of dropper	Pipe diameter \varnothing and dropper spacing		Length and initial distance, m	Manometer pointer at 0.2 m., m. water u.	Pressure loss along the length, m. water u.
		sm	mm			
“Agro Drip”	$i=-0,00455$ cylinder	50	16	193; 0,20	20,688	16,9997

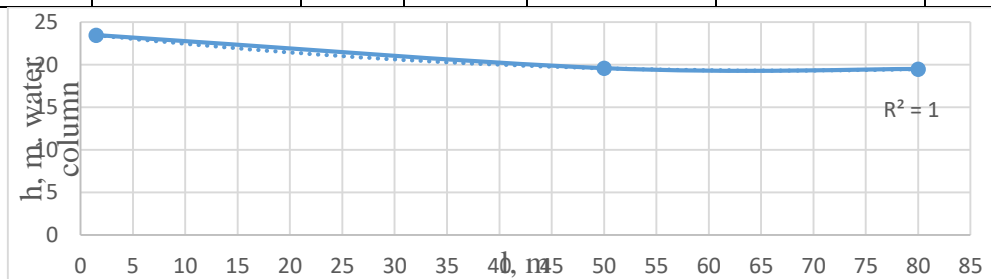


Fig. 6. Variation of pressure loss along the length of the irrigation pipe ($l=80$ m) when fertilizer mixture is added, when $i= 0.00235$.

Based on the analysis of the results of practical studies, the expression (8) was obtained on the basis of Figure 6 (graph).

$$h = 0,001 \cdot l^2 - 0,1675 \cdot l + 23,109 \quad (8)$$

Expressions (10) allow to determine the waste pressure consumption along the length of the pipe during the movement of the fertilizer mixture during drip irrigation.

Conclusion. Depending on the water pressure and consumption in the pipes of the drip irrigation system, the diameter of the irrigation pipe is 16 mm in 193 m. Scientific studies were conducted when the distance between the drippers was 30, 40, 50 cm. In the course of the research, it was determined that the pressure and consumption were unevenly distributed along the length of the drip irrigation pipe. that the difference between the points should not exceed 10%, based on the analysis of the research results, it is advisable to take into account the length of the drip irrigation pipe to the topography of the place, as well as the waste of pressure, together with the requirements of GOST ISO 9261-2004 in the design of the drip irrigation system.

Suggestions: Optimal lengths of drip irrigation flexible pipes at different slopes were determined.

- In order to reduce liquid and water consumption and pressure drop in drip irrigation systems, it is advisable to use counter irrigation methods on flat land with a slope.

- The distance between "**Agro Drip**" drippers is 50 cm. The maximum length of the drip irrigation pipe is 65-70 m.

- "**Netafim**" firm flat dropper spacing is 40 cm. The maximum length of the drip irrigation pipe is 120 m.

- "**Marv imkon**" LLC 30 cm spacing of solid flat drippers. The maximum length of the drip irrigation pipe is 80 m.

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