Research of Influence of Wind on Water Jets While Watering Lawns

Vadym Orel[1], Natalia Potsiurko[2]

[1]Department of Hydraulic and Sanitary Engineering, Lviv Polytechnic National University, 12 Bandera Street, Lviv, Ukraine, 79013, e-mail: vadim_orel@yahoo.com

[2]Department of Hydraulic and Sanitary Engineering, Lviv Polytechnic National University, 12 Bandera Street, Lviv, Ukraine, 79013, e-mail: pocjrko@ukr.net

Abstract – The effect of wind action to water jets during watering lawns has been analyzed. Experimental equipment has been modernized to investigate the influence of wind velocity. Appropriate methodology has been suggested.

Key words – influence of wind, lawns watering, water jets.

I. Introduction

Watering of lawn must completely provide irrigation of their area. Therefore it is necessary to take into account the speed and direction of wind, which acts on jets of water.

II. The aim of the work

The purpose of work is to design experimental installation for study effect of wind action on water jets during watering lawns.

III. The impact of wind speed and direction while watering lawns

The trajectory of angled water jet with pressure up to 7 m is close to the parabola [1]. Without influence of wind action the maximum flight range of fluid occurs both with regard to friction drag in the air, and without it, the angle to the horizontal axis water outlets $\alpha = 45°$ [2:25].

Water consumption for watering territory liters/day

$$Q = q \cdot F \cdot N, \quad (1)$$

where q – is calculated (annual average) daily water consumption for watering, (liters/days)/meter²; for previous calculations is taking by [3:6.1.4];

F – area of watering, m²;

N – number of watering.

When watering sprinkler with a uniform distribution of irrigation from water pipeline land area rectangular m²

$$F = L \cdot (n - 1) \cdot l, \quad (2)$$

where L - the length of the path of the water jet, m;

l – the distance between water outlets, m;

n – number of water outlets.

In comparison to the total absence of wind the oncoming airflow reduces length, while passing – increases length of water jet path [2:81]. In the first case the wind blows a jet stream of water; the wind stream refers to the leeward side and does not cover horizontal projection [4]. This reduces the area of watering, and watering is uneven. Changing the angle α has more impact on the height Z of water jet than on its length of path L. In the second case considered appropriate to increase the angle α, which increases length of jet path [5]. When the speed of air flow is horizontal and does not depend on the ordinate, as well as linear dependence of the resistance movement of the speed u [2:78], it follows that the height of the jet Z does not depend on the wind, but abscissa point extremum varies with change speed u [2:79] (see figure) as mentioned above.

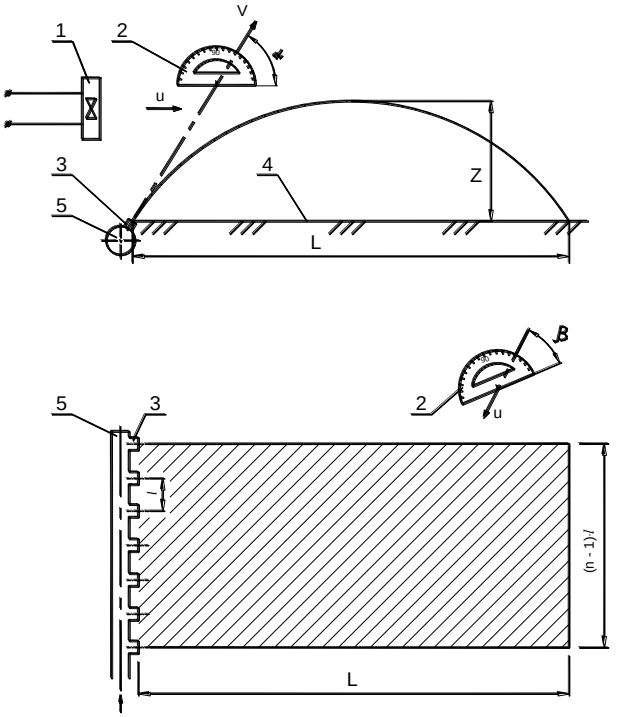

Fig. Scheme of area measuring watering square and length and height of the trajectory of the jet of water under the action of the wind:
1 – axial fan; 2 – protractor; 3 – water outlets;
4 – plane comparison; 5 – experimental pipeline

When a side wind acts trajectory of the water jet becomes a spatial line [2:80]. When air flow is horizontal and perpendicular to the vertical plane passing through the axis of water outlets (outflow jet plane) [2:79] of lateral wind speed depends abscissa or ordinate in the horizontal plane (depending on which axis coordinates wind velocity vector is collinear) [2:80]. This coordinate determines the trajectory deviation from the "flat rate" and affects the flight range of fluid [2:80-81]. Case Action airflow at an arbitrary angle β to the plane of the jet outflow (see. figure) can be represented as action of counter and lateral flows [2:81].

IV. Experimental equipment

Bases on scientific-experimental laboratory No.27 Department of Hydraulic and Sanitary Engineering the experimental equipment was installed and upgraded, described at **[6]**.

Since the experimental setup is short range jet **[6]**, the observation of wind conditions appropriate to a height of 0.4...3.5 m **[7]**. After measuring the flow of water through the water outlets *3* experimental pipeline *5* by the methodology, presented at **[6]**, research of influence of

wind effects water jets while watering lawns were made in following sequence (see figure):

1. Tilled experimental pipeline *5,* so that water outlet *3* formed with the comparison plane *4* certain angle α.
2. Measured angle α by protractor *2*.
3. Measured length L and height Z of water jet trajectory using a metal ruler.
4. Set up axial fan *1* along water jets.
5. Turned on axial fun *1*.
6. Measured air velocity using anemometer.
7. Repeated action n.3.
8. Turned off axial fun *1*.
9. Repeated actions 3–8 by varying the amount of water flow in the experimental pipeline *5*.
10. Changed angle α.
11. Repeated actions 2–9.

Similarly, research was conducted along and opposite side of axial fan 1 to the jets of water, and at the certain angle β of his inclination. In the latter case, measured angle β by protractor *2*.

Conclusion

Based on the review of the literature analyzed influence of the wind action on water jets while watering lawns. To investigate the impact of wind was modernized existing experimental equipment. The method of measuring the length and height of the trajectory of water jets for certain wind velocity was presented.

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