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Problems in the Textile and Light Industry in the Context of Integration of Science and Industry and Ways to Solve Them

(PTLICISIWS-2022)

Namangan, Uzbekistan • 5–6 May 2022

Editors • Sherzod Korabayev, Plekhanov Aleksey, Hüseyin Kadoğlu, Salikh Tashpulatov and Nosir Yuldashev

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CIVIL ENGINEERING

New Technologies to Reduce Water Waste in the Cultivation of Agricultural Crops

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Abstract. In order to reduce water wastage (up to 20%) in the cultivation of agricultural crops, it is recommended the use of the method of V-shaped furrows (more than 90%), which is currently widely used on farms, with parabola profile and compacted furrows.

Keywords. Water consumption, alternative implementation, excavator, soil moisture, V-shaped furrow.

INTRODUCTION

The water consumption required for washing saline soils, providing wet water and growing agricultural crops is increasing year by year. Nowadays, the shortage of water in the cultivation of agricultural crops exacerbates this problem, and therefore the reduction of water wastage in agriculture has become very important for the state [1].

Soil fertility, heat and moisture are the most important factors determining plant growth in the cultivation of agricultural crops. For this reason, the alternative implementation of these three factors is currently the most important task of our time in agricultural practice - the alternative use of water resources in times of water scarcity.

Because in the conditions of our republic, water is the main creative factor in this trio and at the same time the most expensive (invaluable) and scarce resource (source). In our conditions, more than one third of the cost of agricultural products as a result of irrigation in irrigated agriculture is spent on water and its supply. Therefore, today the maximum water saving and its efficient water use is the basis for effective management of irrigated agriculture [2 - 4].

MATERIALS AND METHODS

The analysis of the results of research work and practice shows that the irrigation processes and works in the cultivation of agricultural crops are scientifically based methods because they are unable and unmanaged in the process of cultivation of the crops, causing excessive water wastage in the irrigation of the crops. This in turn leads to a decrease in the crop yields grown in agriculture [5-7].

Lack of water when irrigating crops leads to retardation of plant development (fall of leaves and stems of cotton, etc.).

At the same time, give the furrows more than water:

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- increase in degraded (decommissioned) lands;
- leaching of nutrients from the ground and their addition to groundwater;
- pollution of water resources and exacerbation of environmental problems;
-reduction and loss of nutrients in the body of plants and in the soil;
- increase in groundwater level;
- causes secondary salinization of soils and soil erosion [2, 4, 5].

The analysis of the results of research and long-term practice of farms revealed that the following problems exist in the cultivation of crops on irrigated lands in the present days:

- inefficient use of water resources and the resulting water shortage;
- Irrigation of crops by the method of tillage and the provision of wet water, the water is not evenly distributed between the rows and the depth (up to 40 cm of moisture) and not sufficiently moistened, and as a result the plant is very underdeveloped;
- The main part of the water supplied to the fields during irrigation flows in a vertical direction without being transferred to the vegetation, and therefore the maximum water consumption (up to 35%) and soil erosion, which exists in the practice of agriculture and water management in the country;
-reliability in the implementation of irrigation due to the above shortcomings, low crop yields and product quality [5 – 7].

V-shaped method of furrow (up to 90%) has been used in agriculture of the Republic for many years. This method is the main one for irrigating technical crops such as cotton, corn, oats, sunflower, beetroot, etc.

For the time being, this method saves a relatively large amount of water compared to floor irrigation methods (wheat, some forage crops, etc.), allows full mechanization of technological processes, changes in soil structure and reclamation, very little between crops. and a flat moistening and plant growth of at least 40 cm in depth is ensured [2
- 7].

The advantages of this method are: relatively light and inexpensive; all types of machinery can irrigate crops even on flat, mountainous and sloping lands; there is an opportunity to use water alternatively; it does not require much investment and farmers have been familiar with these technologies for many years.

However, this method also has the following disadvantages: it requires a high level of labor resources and skills;due to excessive watering of the field, its wastage increases and the plants die; soil erosion occurs due to uneven distribution of water to the fields and the yield on the field surface remains different; quality leveling of the field is required; it is difficult to control the uniform distribution of water and water consumption in the field.

In order to eliminate the above shortcomings, modern drip irrigation methods are being introduced in the country. However, due to the fact that the introduction of drip irrigation in agricultural practice requires the solution of more complex issues, at present its share in our country remains no more than 10% [2, 3, 5, 7].

At present, on the basis of standard technological maps for the care and cultivation of major agricultural crops (2015-2020) for irrigation of cotton, corn and other similar crops, V-shaped (Figure 1a) furrows between rows: 60 sm between rows: h = 10-18 sm; Between rows of 90 cm: at a depth of h = 15-25 sm type of KXU-4B or other cultivators are carried out using furrows (Figure 1b) [2, 3].

At the same time, some farms in the region prepare V-shaped furrows at a depth of h = 15-25 cm using a chisel cultivator ChKU-4A to provide moist water to the soil before planting (Figure 1b).

In this method, most of the water flowing from the field in the irrigation of agricultural crops is not fed to the roots of the crop, but along with mineral and organic fertilizers given for plant development (especially in the first water) flows directly into the soil in a vertical direction. In stony and sandy soils, some of the furrow water is added to the groundwater (drainage). As a result, the height of groundwater increases, and in some cases there is a phenomenon of secondary salinization [2,7].

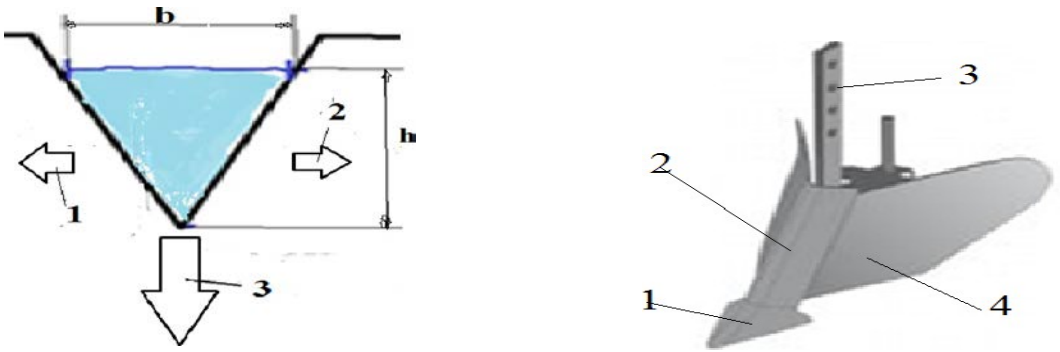

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FIGURE 1. The method of irrigation of agricultural crops by the method of V-shaped furrow, its parameters and directions of infiltration (filtration) of water into the ground: in the horizontal flatland (1, 2); in the vertical flatland (3); b- furrow excavator construction: 1-knife, 2-frontal separator, 3-column, 4-wing.

The employees of the Tashkent Institute of Irrigation and Agricultural Mechanization Engineers analyzed the experience of many years of research, development and patent research, as well as agricultural and water management practices in the study of irrigation methods used in the cultivation of agricultural crops.As a result, in order to overcome the above-mentioned shortcomings in the process of V-shaped irrigation of industrial crops, which are currently widely used in agricultural and water management practices, compaction (trampling) using mounted base wheels was proposed (Figure 2) [8, 9].

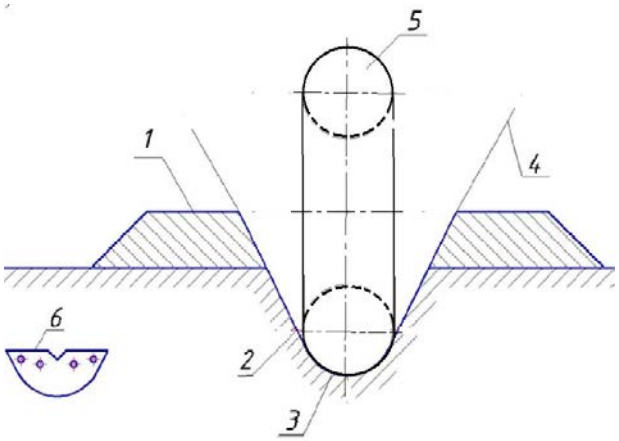

FIGURE 2. The proposed cross-sectional shape of the proposed excavator which excavats furrow: 1-cavalry; 2 - side and 3 bottom part; 4 - parabola; 5 - base wheel;6-parabola-shaped blade (lemex).

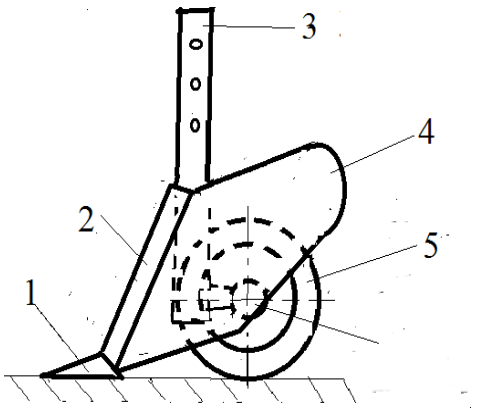

FIGURE 3. The proposed schematic design of the excavator which excavats furrow: 1-blade, 2-front separator, 3-column, 4-wing, 5-support wheel.

The proposed knife for making the proposed cross-section parabolic geometric shape - 6 base has the shape of the lower part of the parabola (Figure 2), it is necessary to replace it with a rubber base wheel 5 with a parabolic cut surface on the back (Figure 3).

The design of the excavator (Figure 2, 3) proposed by the authors fully meets the requirements of agrotechnics, agro-amelioration and ecology, mechanically compacted part 3 and side 2 of the field, the water supplied to the field is minimized in the vertical direction (filtered), transverse The cross section produces 4 branches of parabola geometric shape.

As a result of the analysis of the results of research work on the study of soil moisture contour in the irrigation of crops by the method of V-shapedfurrows, it was found that the moisture contour of the moisture content when irrigating crops by this method is circular [5 - 7]. As a result of the analysis of the research work carried out to study the process of irrigation, it was found that very little of the water supplied to the field leaks to the left and right

sides of the field, and most of it leaks vertically through capillaries to the ground under gravity and atmospheric pressure.

In the scientific literature, it is scientifically based that the amount of water leaking (filtration) in the vertical and horizontal directions depends on the type and structure of the soil, physical and mechanical properties and other factors [5 - 7]. That is, water infiltration is more in sandy and sandy soils, less in sandy and loamy soils, and its value is significantly reduced in hard clay soils.

The plot of soil moisture in the irrigation of technical crops by the method of parabola-shaped furrows, proposed by the authors, is predicted by the authors in an oval shape. As a result of the analysis of this method, when irrigating crops in the existing furrow method, most of the water tries to leak vertically through the capillaries to the ground under the influence of its gravity and atmospheric pressure, but the amount of water leaking is reduced to 4 minimum due to compaction.In this method, when irrigating crops, the bulk of the water supplied to the furrows flows 3 in a horizontal direction to its left and right sides and is delivered through 5 capillaries to moisten the plant roots. Therefore, this method is expected to reduce water waste by 10-20% in the cultivation of agricultural crops.

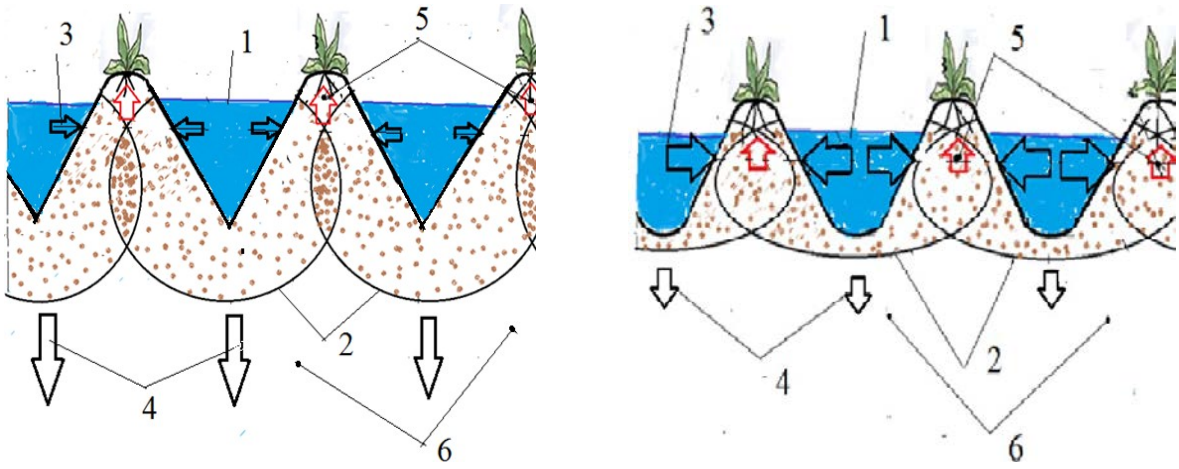

FIGURE 4. Soil moisture contour that occurs during the irrigation of crops: a - by the method of V-shaped furrow; b-method of parabola furrow; 1-watery furrow, 2-the moisture content of the furrow, 3-water leaking in the horizontal flatland, 4-water leaking in the verticalflatland, 5-capillary rise, 6-dry soil.

CONCLUSION

1. At present, the farms of the republic use mainly V-shaped furrows for irrigation of technical crops, and in our opinion, this method has the following disadvantages:
- It requires a high level of complexity, labor resources and staff skills;
- Due to the fact that the root part is not compacted, a lot of water is given (especially in water 1 and 2), its loss increases and as a result the plants die;
- soil erosion occurs due to uneven distribution of water in the fields;
- Due to the lack of a smooth and high-quality surface of the field, plants develop at different levels, and therefore the quality of their products remains different;
-smooth distribution of water in the field and it will be difficult to control water consumption.)
2. It is estimated that as a result of the application of the proposed method of cultivation in the form of parabola in the cultivation of agricultural crops, water consumption will be reduced by 10-20%.
3. In sandy and sandy soils, in order to reduce excess water loss, mulching (clay soil, granular minerals) can be predicted to reduce water loss in these soils by 10-20% (in this regard, PSEUETI research has been going on for many years, but for various reasons this method has not been put into practice.

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