ENERGY-SAVING DEVICE FOR TEMPORARY DITCH PRODUCTION

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Absract: The article describes the research on the improvement of the temporary ditching device. In order to reduce the traction resistance of the channel and improve the channel quality, two straight discs are installed in front of the channel. During the excavation, the slope of the temporary ditch was maintained at the required level due to the partial disintegration of the soil layer due to the rotational movement of the disk, and the issue of maintaining the uniformity of the temporary ditch side wall was discussed.

Agriculture is one of the most important sectors for economic development, employment and income growth. Therefore, measures are being taken in the Republic to develop agriculture on the basis of modern requirements and strategic approaches.

The Address of the President of the Republic of Uzbekistan to the Oliy Majlis of December 29, 2020 emphasizes the further development of agriculture and water management, as well as all other sectors. A number of important tasks have been identified, such as modernization of agriculture, digitization, increase of land productivity, introduction of modern agro-technologies, increase of land area by five times with introduction of water-saving technologies [1].

Today, special attention is paid to further improvement of melioration condition of irrigated lands, development of irrigation network, wide introduction of intensive methods, above all, modern techniques and technologies saving water and resources to the sphere of agricultural production. In this regard, the application of modern water-saving technologies, the maintenance of irrigation networks in a state of constant technical downtime, the creation and production of energy-saving techniques and technologies is of great importance.

It is known that the improvement of land reclamation, increasing crop yields depends on self-irrigation. Irrigation networks are used to irrigate agricultural crops. Irrigation networks are divided into permanent and temporary networks according to the period of use. Temporary irrigation networks will be removed at the beginning of the irrigation season and leveled at the end of the irrigation season. To dig temporary networks, levelers are used: they make the channel 20 - 40 1 / sec. and 100 - 200 1 / sec. is selected taking into account the water permeability [2,3,5].

In irrigated lands in Central Asia, the method of irrigation of agricultural crops above the soil level (rut and corridor invasion) is widely used, and interim irrigation networks are placed in cross-and longitudinal schemes on the irrigation site, depending on the states of the location.

Longitudinal positioning schemes are used on lands where the slope is smaller than 0,002 (figure 1.2 a). On such lands, the plot divider is taken in the direction of the largest slope, while the interim arcs are taken in the direction of the slope perpendicular to the height horizons, and the slopes in the direction of the smallest slope. Beshamaks are built on the oars without a parallel, water from each of them is distributed to 5-6 irrigation racks. Watering egos are opened in the direction of a large slope of the place, that is, they are parallel to the direction of the interim arc.

In order to prevent the washing of the soil under the influence of irrigation water on lands with a large slope, interim irrigation networks are placed in a cross-sectional scheme. On such lands, the plot divider is obtained perpendicular or sloping relative to the height horizons. The spikes are taken in the direction at a small angle to the horizons, and the irrigation curves are taken perpendicular to it. Bunda is distributed directly from the oars to the fattening rags.

The recommended moderate dimensions of temporary irrigation networks are given in Table 1 (NT Laktayev).

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Indicators of temporary ditch	Placement scheme	
	longitudinal	transverse
Maximum length, m	600-800	400
Minimum length, m	300-400	300
Maximum water consumption, 1 / sec.	60	40
Minimum water consumption, 1 / sec.	10	10
Distance between temporary ditches, m	70	according to the length of the edge

The depth of the ditch should not exceed 30 cm and the walls should be horizontal, ie the slope should be around 1: 4, so that agricultural machinery can pass through the temporary networks.

To date, many types of devices for the formation of interim irrigation networks in agriculture have been created and are being used in production.

UKP-rated thresholds and interim channel forming device are aggregated in the position of the tractor trailer, applied in order to open the interim ditch or form thresholds in irrigation areas on account of changing the working body condition. Depending on whether the dimensions of the formed interim slab or pawl are installed in RAM, respectively, the depth of access to the soil is adjusted by the recessed pull above the device.

The GPU-2000 a duty pawl forming device has universal RAM, which can be replaced by working bodies, that is, a two-way submersible channel digger, a two-way submersible pawl forming machine, a sink and a recessed working bodies. This device is aggregated in the trailer position to 4-5 klass tractors, such as DT-54, DT-75, t-750 mm. it is used in the formation of pawls with a height of up to. The working depth is up to 300 mm, the working volume is 1,2-1,6 km/h.

Currently, the kzu – 0,3 d threshing device is widely used in the separation of fields into small contours with the help of thresholds in order to prepare the fields emptied from the crop and plowed for autumn saline washing and spring irrigation. This device is aggregated to MTZ-80.1, DT-54A, MXM-140 and other similar types of 3-4 klass tractors, and the working output is 1.2 km/h (figure 1.4) [6].

Trailer-mounted channel digging machines are mainly in the grills of the first group, with a depth of 0,8...Eni of the channel bottom of 1,2 m 0,2...It is designed for digging channels up to 0,4 m.

In order to create temporary irrigation networks for irrigating crops in irrigated agriculture of the country, ditches KOP-500A, KZU-0.5, KPU-2000A, KBN-0.35, KZU-0.3 are used. These dredgers are required to dig the soil, lift the excavated soil and place it on the edge of the canal and push it, as well as level and smooth its surface, as well as ensure its slope [6,7]. Analysis of these ditches shows that digging ditches in hard areas requires a lot of energy, in areas with low humidity, the increase in the amount of large lumps and the loss of geometric shape as a result of deformation of the work equipment, the large amount of energy required to pull the work equipment during the digging of the ditch, the magnitude of soil resistance.

In view of the above, in order to increase the efficiency of the temporary ditch excavator, proper discs were installed on the front of the dump to reduce the soil softening resistance and improve the quality of the soil fraction and slope. (Figure 1) In view of the above, in order to increase the efficiency of the temporary ditch excavator, proper discs were installed on the front of the dump to reduce the soil softening resistance and improve the quality of the soil fraction and slope. (Figure 1) In view of the above, in order to increase the efficiency of the temporary ditch excavator, proper discs were installed on the front of the dump to reduce the soil softening resistance and improve the quality of the soil fraction and slope. (Figure 1)

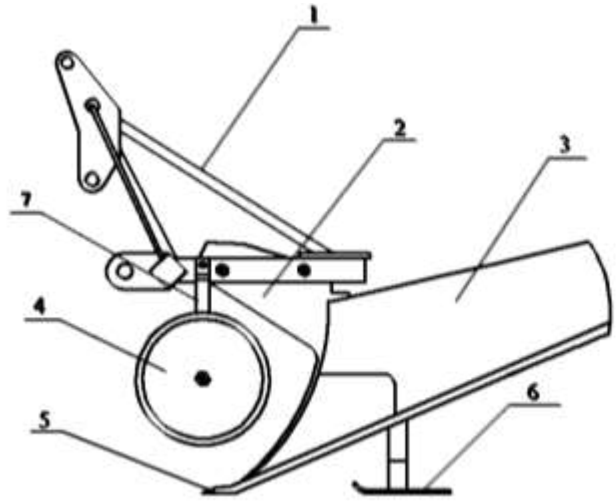

Figure 1: General view of an improved temporary ditch

Advanced ditch frame 1, main working equipment frame 2, overturner 3, straight discs 4, lemex 5, ski 6, disc o mounted on its front at a distance of 30 - 35 cm from each other The installed racks consist of 7. The straight discs are mounted to the racks 7 using a mounting bracket – arrow [4]. The technological process of operation of the advanced trench is as follows: the trench is mounted on the back of the tractor and put into operation. Due to the forward movement of the tractor, the working equipment is lowered to the ground at a certain depth. In the process of digging a temporary ditch, the cutting straight discs, placed at a certain distance from each other, sink into the soil and cut the soil in front of the overturner at a specified depth by rotating around its axis as a result of contact with the soil. the cut soil layer is pushed sideways using a roller to form a channel. As a result, the tensile strength of the unit is reduced during operation. During the excavation of the ditch, a quality ditch is formed as a result of ensuring the uniformity of the slope and geometric shape of the side of the ditch due to the cutting of the soil layer using discs [8,9].

The force required to cut the soil using discs can be determined by the following formula:

$$P = T + rp_1(\cos\theta_2 - \cos\theta_3) + rp_2(\cos\theta_2 - \cos\theta_1) + rp_1(1 - \cos\theta_1) + \\ + f_1 rp_1(\sin\theta_2 - \sin\theta_3) + f_1 rp_1 \cdot \sin\theta_1 \qquad (1)$$

here $T = 2fqS$ - friction force on the side surfaces of the disc cutter (kg);

(q is the normal pressure of the soil on the side surface kg/cm^2);

S is the segment surface (cm2) determined by the depth of sinking of the disc cutter;

f – coefficient of soil friction with metal);

r – disc cutter radius (cm);

p_1 – specific pressure at sliding by cutting using a cutter (kg/cm)

p_2 – specific pressure at shear without shear (kg/cm)

f_1 – coefficient of friction of peat soil along the cutter

$\theta_1, \theta_2, \theta_3$,– central angles determined by the following dependencies:

$$\cos\theta_0 = \frac{r}{r+\Delta r}, \qquad \cos\theta_1 = \theta_0 - \varphi_1, \qquad \theta_2 = \theta_0 + \varphi_1, \qquad \cos\theta_3 = \frac{r-h}{r},$$

Them $\Delta r = \frac{Er}{1-E}$,*- the distance from the lower end of the base diameter to the instantaneous rotation pole (E - slip coefficient,* φ_1- angle of friction of the peat along the cutter, h - depth of run with a disc cutter, cm).

The formula allows you to determine the total amount of cutting movements with discs, as well as its components - cutting with a knife and frictional movements on the side surfaces of the cutter. As the diameter of the discs increases, the cutting action of the soil decreases unless other conditions change. Spherical discs (concave) rotate freely around the horizontal and oblique axis under the influence of the reactive resistance of the soil during the input movement of the device. The speed of any point on the disk can be determined by geometrically adding the input speed of the device and the rotational speed of that point around the instantaneous rotation pole.

The reaction forces acting on the transverse disc are bent by the frictional force on the side surface caused by the force and pressure applied to the blade. They can be applied to two forces: a disk disk lying in a plane and a disk disk lying on a parallel axis of rotation, and a disk disk intersecting a plane at the center of gravity of the segment, which are determined by the depth of sinking. These forces cannot be brought into an equally moving element. Therefore, their size cannot be determined analytically [10]. A solution to this problem can be found if we add additional equations to the static equilibrium based on the theory of material distortion. Then the magnitude of the transverse gravitational motion can be determined by the following expression:

$$P = 2p_2 r\left(1-\cos\frac{\theta}{2}\right)\cos\alpha + k_4 S\frac{\cos\rho}{\cos^2\left(\frac{\delta+\varphi+\rho}{2}\right)}\cdot\left[tg\varphi\cos\alpha + \sin(\delta+\varphi)\sin\alpha\right], \qquad (2)$$

here r - disk radius (cm);

p_2- Specific resistance of soil to shear with a non-slip blade;

α - Mounting angle of the discs to the line of gravity;

S - Segment area (cm^2) determined by the sinking depth of the disk;

k_4 - Soil shear resistance (kg / cm^2);

φ- Angle of friction of the soil with the metal;

ρ - Angle of friction of the soil with the soil;

$\delta = i + \varepsilon$ (ε - back corner, i - front corner);

θ - central corner.

$$\cos\theta = \frac{r-h}{r},$$

Where h is the disk travel depth.

The study of gravity and agronomic evaluation of the quality of disk drive performance showed that:

1) As the diameter of the disc increases, the gravitational force as well as the force per disc decreases;

2) As the mounting angle between the discs and the gravity line increases, the total power, the power per disc, and the unit coverage also increase.

3) In this case, the total power can be calculated by the following relationship:

$$P^{/} = P_o^{/} + 10\alpha^{1,15}, \quad (3)$$

here $P_o^{/}$ - $\alpha = 0$ gravity under conditions;

α - the angle of installation of the discs relative to the line of gravity;

As the distance between the disks increases, the gravitational resistance per unit of coverage decreases, and the gravitational resistance per disk increases as each disk passes through an independent space.

References

1. Address of the President of the Republic of Uzbekistan to the Oliy Majlis of December 29, 2020. People's Speech December 30, 2020 No 276
2. Artukmetov Z A, Sheraliyev H Sh, 2007 *Basics of crop irrigation. T.*
3. Imomov Sh., Jurayev A.., Ruziqulov J., Kurbonboyev S., Ruziqulova D., Xusinov S., Madadkhonov T. (2022). THEORETICAL STUDIES ON THE DESIGN OF TRENCHER WORK EQUIPMENT. Eurasian Journal of Academic Research, 2(12), 989–996. https://www.inacademy.uz-/index.php/ejar/article/view/6504
4. Sh.J.Imomov, J.U.Ruzikulov, S.S.Kurbanbayev, H.S.Safarov, K.S.Sobirov, and Z.Sh.Isakov "Technological process of provisional dig a ditch", Proc. SPIE 12296, International Conference on Remote Sensing of the Earth: Geoinformatics, Cartography, Ecology, and Agriculture (RSE 2022), 122960O (6 July 2022); https://doi.org/10.1117/12.2642980
5. Energy-saving device for temporary ditch digging I S Hasanov1, J U Ruzikulov1, F A Ergashov1, M J Toshmurodova1 and M R Sotlikova1 Published under licence by IOP Publishing Ltd IOP Conference Series: Earth and Environmental Science,

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6. Ruzikulov Jasur Uktam ugli, Kurbanbayev Sindorbek Sarvarbek ugli, Nasrullayev Alpomish Anvarjon ugli, Safarov Khusniddin Sirojiddin ugli, Research on the establishment of an improved temporary ditch production device, Galaxy international interdisciplinary research journal (GIIRJ), Volume 9, Issue 11, November, 2021
7. Ruziqulov Jasur Uktam ugli, Isakov Zafarjon Shuxrat ugli, Qurbonboyev Sindorbek Sarvarbek ugli, Ruziqulova Dilnoza Uktamovna, Xusinov Sarvarbek Nodirbek ugli. (2022). INCREASING THE WORKING PRODUCTIVITY OF THE CASE 1150 L BULLDOZER BY IMPROVING THE WORKING EQUIPMENT. Neo Science Peer Reviewed Journal, 4, 87–90. Retrieved from https://www.neojournals.com/index.php/nsprj/article/view/83 .
8. Ruziqulov , J. ., Kurbonboyev, S. ., Xusinov, S., & Ruziqulova , D. . (2023). IMPROVEMENT OF THE SCRAPER WORK EQUIPMENT AND IMPROVING ITS EFFICIENCY. Eurasian Journal of Academic Research,3(1 Part 4), 12–16. https://incademy.uz/index.php/ejar/article/view/8935
9. Khasanov, U., Jurayev , A., & Mamedov, A. (2023). PROCESSES OF IMPROVING SOIL WITH METAL AND SOIL WITH SOIL DURING MAIN SOIL WORKING. International Bulletin of Applied Science and Technology, 3(6), 736–739. Retrieved from https://www.researchcitations.com/index.php/ibast/article/view/1997
10. A. A. Jurayev. (2021). THE RELATIONSHIP BETWEEN THE UPTAKE OF NITROGENOUS NUTRIENTS BY SUGAR BEET AND THE NORMS OF MINERAL FERTILIZERS. Conferencea, 1–4. Retrieved from https://www.conferencea.org/index.php/conferences/article/view/109
11. Khasanov, U., Jurayev , A., & Mamedov, A. (2023). THE RESULTS OF THE STUDY OF PHYSICAL, MECHANICAL AND TECHNOLOGICAL PROPERTIES IN BASIC SOIL CULTIVATION. International Bulletin of Applied Science and Technology, 3(6), 733–735. Retrieved from https://www.researchcitations.com/index.php/ibast/article/view/1996