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CUTTING HARD STEM PLANTS FROM RECLAMATION CANALS WITH BUCKET MOWER

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Abstract: *The article is devoted to the problem of mowing land-reclamation canals with the help of a bucket-mower using the new technology developed at the Scientific-Research Institute of Irrigation and Water Problems. The main task of this research is to maintenance of the reclamation canals in working condition by developed measures. In the article aimed at improving the reclamation condition of irrigated lands of the Republic of Uzbekistan.*

Key Words: *Bucket-mower, improvement, melioration, canal, drainage, coarse stalk, vegetation, water, cutting, repair, operation.*

1. INTRODUCTION:

The total length of the ameliorative canals in the earthen channel in the Republic of Uzbekistan is 34729 km and 70,000 km including: inter-farm collectors and open drainage, respectively.

A survey of the technical condition of the ameliorative canals showed that most of them are overgrown with coarse-bellied vegetation (reed, sedge, cattail, etc.). With a shallow depth (or in active changes of the water level) and sufficient warming up of the water column, coarse stalked vegetation begins to grow at the bottom of the amelioration channels [1].

2. LITERATURE REVIEW:

Touching upon the history of agricultural development in the arid zone of Central Asia during the tsarist period, it should be noted the prominent role of the famous geologist-climatologist A.I. Voeyky in assessing microclimatic conditions: he first put forward the concept of the existence of a somewhat closed circuit of moisture coming from the west and southwest, between the high Pamir-Alai mountains and the fertile plains of Central Asia. A study of the climatic, soil and hydrological conditions of the Aral Sea basin led Voeikov to the following conclusion: “In no other country can a person perform cultural work on a larger scale than in Turkistan. In the distant future, with the desired successes of hydrotechnical industry and agriculture, we must use all the water of the Aral basin in wet years for artificial irrigation”. So, apparently, the history of intensive development of irrigated agriculture in Central Asia began with the work of A.I. Voeikov in the 20th century. First of all, scientists began to search for the area, the soil and climatic conditions of which are suitable for the production of fine-fiber Egyptian varieties of cotton. At the end of the XIX century. it has been proven that this area is the Vakhsh valley in southern Tajikistan. In particular, at the beginning of the 20th century, studies by engineer Gayevsky showed that the hydrogeological and soil-climatic factors of the Vakhsh valley satisfy all conditions for the development of cotton culture, where in most cases the groundwater level in irrigated fields is at an optimal depth, not closer than 5 m from the surface.

Scientists of the world began to deal with water use planning issues only from the middle of the 19th century. For example, the early legislative acts adopted: in the United States on the use of desert lands and on water use rights in the dry states, in Egypt and Sudan on the study of irrigation regimes based on the irrigation systems of the basin, are known Nile and other rivers. It should be noted that the basis of the water legislation of India during the period of British rule was the principle: the irrigation system is a profitable commercial enterprise.

3. MATERIALS AND METHODS:

Practical and theoretical value. The development of physically justified and effective formulas for calculating the hydraulically most advantageous elements of channels of various cross-sectional shapes, the assessment of the kinematic and hydrophysical characteristics of the fluid flow in pressure and pressureless channels are the main tasks of technical hydromechanics and channel hydraulics. The formulas of hydraulically most advantageous channel elements obtained by applying mathematical modeling methods, the formulation and solution of the problem of vertical filtration in layered soils, the new model formulas for one-dimensional turbulent flow - all this is new in the hydraulics of rectilinear channels. The calculations based on these formulas in assessing the hydraulic parameters of the irrigation channels and the flow characteristics in these channels show the effectiveness of the formulas obtained and are of practical interest in

other issues of hydraulics, hydrology, and the theory of channel processes.One of the most important operational measures aimed at maintaining open irrigation and collector-drainage canals is to clear them from vegetation which the presence of vegetation in canals reduces their capacity, leads to siltation, reduces speed, delays the flow of water, and increases evaporation losses [1].

Researches on the collector-drainage and irrigation canals of Uzbekistan have shown that:

- magistral, on-farm channels are overgrown with up to 65-70% of the length;
- collector-drainage and irrigation network of canals grows to 90-95% of the length [1].

The overgrowth of the collector-drainage network initially develops intensively on the slope and its base. Under favorable conditions and sufficient heating of the water column vegetation grows at the bottom of the channel. Overgrowth of the vegetation leads to its decrease, reducing the speed of water flow, which affects their transport capacity and, accordingly, increases the level of groundwater. In addition, overgrowing increases the coefficient of roughness, reduces throughput, and accelerates siltation, overgrowing of internal slopes above the water level in the channels, as well as external slopes and the underground water table. All this complicates access to the collector-drainage network, therefore, its operation [1].

The use of primitive technologies and tools, when mowing collector-drainage networks requiring a lot of physical effort, the question arose of finding more productive and efficient technologies and means for removing vegetation and sediment. These searches have been carried out for over a hundred years. During this period, both abroad and in our country, designers have developed various technologies, types of machines and mechanisms for the care of canals from overgrowing by roughly-stem plants and their repair. However, the problems of mechanization and regulatory support of cutting the collector-drainage and irrigation canals from coarse-bellied vegetation and repair of canals have not been fully resolved to date [1].

The existing production technology of cleaning channels from silting and vegetation overgrowth, single-bucket universal excavators for general construction purposes (due to the lack of specialized technical means) leads to a change in the parameters of the channels. From the bottom and the slopes of the canals, mainly soil blocks with a thickness of up to 0.5 m are pulled out along with the root system of the vegetation [2].

To ensure high-quality cleaning of collector-drainage canals from coarse-bellied vegetation, without changing their shape and size, the development of specialized working equipment is required.

The Institute of Scientific Research Institute of Irrigation and Water Problems has developed a new technology (Table 1) for cutting channel from coarse-stalked and grass vegetation, based on universal one-bucket hydraulic excavators with improved interchangeable tools (mower bucket, Figure 1) [3].

Table 1. Technology of milling and removal of vegetation on irrigation, collector-drainage networks and dams

Operation	Technological parameters	Technical means
Destruction of weed vegetation across the canal section	The green mass of vegetation is estroyed to the ground.	Universal wheeled tractors with a class of 0.9-5.0. The mower for slopes of channels with a productivity of 0,8 hectares
Mowing berms, slopes, bottom in the cross section of channels and dikes on the bottom below the level of drainage water	The height of the cut of vegetation is not more than 7 cm	Excavators crawler, hydraulic bucket capacity from 0.45 to 0.6 m3. The mower with the segment cutting finger up to 3 m wide
Removal of mown vegetation and loading into vehicles	Shedding vegetation on slopes of not more than 10% Loss of green mass of not more than 0.5%	Excavators crawler, hydraulic bucket capacity from 0.45 to 0.6 m3. The mower with the segment cutting finger up to 3 m wide
Transportation of vegetation	Green mass is exported to the place of disposal.	Universal wheeled tractors 0.9-5.0 thrust class. Trailers - dumping capacity 4.0 tons

Figure 1 - The process of mowing coarse-leafed vegetation from the bottom of the collector under water with a bucket mower

The replaceable working equipment developed by the Scientific Research Institute of Irrigation and Water Problems for hydraulic excavator of the 4th dimensional group is an active working body (Fig1). Mower bucket with a cutting apparatus of reciprocating action, is designed for mowing collector canals of a depth of 2 7 m and removing to the canal or into vehicles mowed uncontaminated plant mass.

The working body consists of the following main assembly units: a basket, a frame-bracket, a segment-type cutting apparatus, one lever fixed at one end to the cutting rail, and the other on the rocker mechanism of the swinging washer (gearbox), hydraulic motor, hydraulic ram and lifting mechanism.

The 3 m long widened lattice bucket is a steel frame; the size of the bucket cells is 40x10.6 mm in Table 2 [4].

Table 2. Technical characteristics of the mower bucket with a segment cutting device

№	Name of indicators (parameters)	Value of indicators (parameters)
1.	Overall dimensions of working equipment, mm - width - length - height internal size of the bucket basket along the length of the mower	 3000 1760 1500 1170
2.	Mass of working equipment, kg	600
3.	Hydraulic pump	A-32x2
4.	Pressure of the working fluid supplied to the hydraulic motor, kg / sm^2	180
5.	Rotational speed of the engine crankshaft of the tractor, rpm	2100
6.	Motor shaft speed, rpm	280
7.	Dimensions of attachment planes, excavator-mower (distance between axles), mm	460
8.	Structural installed height of cutting vegetation, mm	105
9.	The dimensions of the holes and gratings that make up the walls and bottom of the mower, mm	40x10,6
10.	Width of the cutting part of the segmental apparatus, mm	3000
11.	The gap between the segments and against the cutting plates, mm	0,3-1,1
12.	The gap between the control plate and the top of the knife segment, no more, mm	0,85
13.	The amount of movement of the segment during operation, mm	106

The mower is driven by the MGP-125 axial-plunger hydraulic motor. Raising and lowering the bucket-mower is carried out by the excavator hydraulic cylinders. For mowing collectors up to a depth of 7.0 m (cutting radius + discharge radius), the parameters of a Chinese single-bucket hydraulic excavator are sufficient.

A distinctive feature of the working body is that the drive mechanism of the cutting knife is located on the right side of the bucket. The working body with a working width of 3 m has one cutting rail with knives.

The cycling bucket mower works like a single-bucket excavator positionally, the cutting unit moves along the perimeter of the channel cross-section. The base machine stands still at this time. After unloading the bevelled mass, the excavator moves parallel to the curb of the channel for a distance approximately equal to 1.5–2 of the cutting width of the cutting unit, stops and the cycle repeats.

4. CONCLUSIONS:

In order to improve the technical, technological and structural parameters of the bucket mower.

1. A reasonable comparative analysis of the features of the use and operation of reclamation mowers of foreign and domestic production was made.

2. The parameters of the technological process of milling slopes and bottom of collectors and open drains of reclamation mowers, which are equipped with four cutting devices of the type: with reciprocating cutting machines, rotary with a vertical axis of rotation, rotary with a horizontal axis of rotation; screw cutting machines.

Based on the analysis of the reclamation mowers, it was established that none of them can perform three technological operations in one pass, namely: mowing, grinding and removing the mown mass from the cutting zone to the berm of the collector. Scientific research institute of irrigation and water problems bucket mower with a segment cutting device that can perform the three above mentioned technological operations is proposed.

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