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Field Test Results of Flat Plow Plug

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Abstract: The quality of tillage with traditional plowing plows does not meet the agrotechnical requirements. The purpose of the research is to develop a plow for smooth, rowless plowing. A plow for smooth plowing is proposed, which contains twin screw housings, first-row colliders, rear screw right- and left-turning plow housings, second-row colliders. An experimental sample of a plow for smooth plowing was made. The results of field tests of the developed plow are presented. It is established that the quality indicators of the plow fully comply with agrotechnical requirements. At the same time, the degree of reduction in fuel consumption compared to the existing plow is 21, 26 %.

Keywords: technology; traditional plowing; ripper; plow; ochik egat; smooth smooth plowing; housing; double housing.

Introduction. It is known that there are plowing and flat plowing technologies [1-3]. Traditional plows are adapted to the own method, which alternately performs "collective" and "separate" plowing (Fig. 1) [1-3]. The main feature of plowing with traditional plows in the own method is the formation of open fields and marshes in the plowed area.

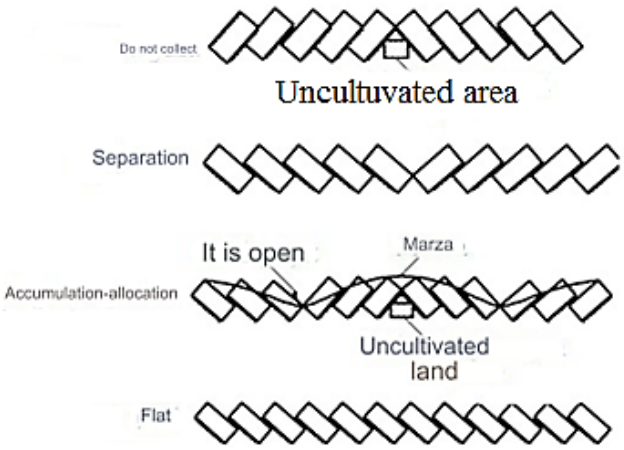

Figure 1. Basic technologies of plowing [5]

According to the results of scientists' research, on the surface of the plowed field, ridges with a width of 120-150 cm and a height of 28-30 cm and open ridges with a width of 120-210 cm and a depth of 30-36 cm are formed [4]. The number of open edges and margins, additional passes and additional area in leveling depends on the field surface, and these indicators increase with the increase of the surface (Fig. 2) [4].

Irregularities formed on the surface of the plow, that is, open edges and edges, worsen the working conditions of aggregates, increase the traction resistance of machines, make harvesting difficult, and do not allow aggregates to be used at high speed.

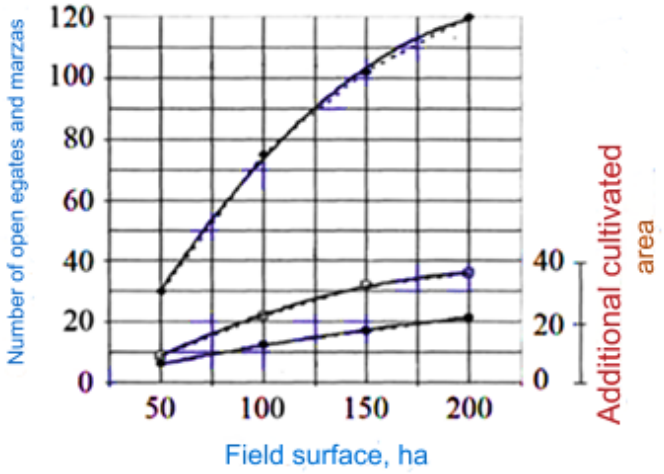

Figure 2. Dependence of the number of open edges and borders, additional passes and additional area in leveling on the surface of the field

Formed ditches lead to the development of water erosion on the slopes. The plow layer in open heaths and marzas is very different from the plow layer in a flat plowed field and has a significant effect on plant development and, accordingly, productivity, because in the areas of heaths and open heaths, seeds are not buried evenly, resulting in their germination and development will not be good. As can be seen from the given data, the wheat yield in the 3 m wide area of open fields is reduced by 30-40%. The total surface area of open meadows and marzas is 6.5% to 19.5% of the total surface of the field [5]. Additional operations performed on leveling the surface of the plow, along with increasing costs, significantly lengthen the period of preparation of the field for planting, lead to rapid drying of the soil and additional water consumption. Thus, the agrotechnical, technical-economic and ecological indicators of the traditional plows used in the main tillage do not meet the requirements of the present time [5]. The purpose of the research is to develop a flat plow plow without an edge.

Materials and methods. Field tests of the plow plowing without a plow were carried out in the fields of farms "Khudaiberdiyev Komil Temirovich", Karshi district, Kashkadarya region. In the tests, the parameters of the flat plow plow without an edge were compared with the parameters of the standard PLN-5-35 plow. Table 1 shows the data on moisture and hardness of the tested field soil.

The flat plow plow developed in closed and semi-open cutting conditions was used in combination with the New Holland T-7060 tractor. The working depth is 25 cm, and the working speed is 8 km/h.

In these tests, the following indicators of plugs were determined: coverage width; processing depth; completeness and depth of burial of plant remains; height of irregularities on the surface of the plow; soil quality.

Cited indicators TSt 63.04:2001 “Testing of agricultural machinery. Machines and tools for surface tillage" va TSt 63.02:2001 "Testing of agricultural machinery. Machines and tools for deep tillage" determined according to The data obtained from the tests were processed by the method of mathematical statistics.

Moisture and hardness of the field soil where the tests were carried out

Sampled layer, cm	Soil moisture, %	Soil hardness, MPa
0-10	8,7	2,88
10-20	10,2	3,87
20-30	12,1	4,66
30-40	13,2	4, 69
0-40	11,9	4, 01

The depth of burial of plant residues was determined by measuring the distance from the surface of the plow to the upper limits of the placement of plant residues. Two vertical cuts were made in each pass. Measurements (accuracy of 0.5 cm and carried out in quadruplicate. The soil compaction quality was determined at six points (three on the movement of the aggregate, three on the return). To determine the compaction quality of the soil, the soil on the surface of 0.25 m2 the sample was taken using a bottomless box measuring 0.5x0.5 m. The samples were divided into fractions larger than 100 mm, 100-50 mm and smaller than 50 mm. The division of the samples into the indicated fractions was done in the field itself with holes of 100 and It was done with 50 mm sieves. First, the large pieces were picked by hand, then the soil was passed through the fine sieves. All fractions were weighed on a scale with an accuracy of ±10 g and divided by the total mass of the soil sample. the ratio was calculated in percentages.

Results. Analysis of previous research and development works, flat plowing technologies and constructions of plows in developed foreign countries [1; 3] and based on agrotechnical requirements for plowing, a flat plow plow was developed in closed and semi-open cutting conditions, protected by the utility model patent of the Russian Federation RU No. 207103 [1; 3]. The unique feature of the technology of this plow is that it performs flat plowing in closed and semi-open cutting conditions of the fields (Fig. 3).

A straight plow works well. Disc blade 1 cuts the soil in a vertical plane. The double hulls separate the 2 planks (Fig. 3) from the bottom and wall of the egate, wait and roll them over the corresponding untreated planks. Pushers 3, installed after the double bodies 2, push the slats to the side by a distance equal to the width of br, without overturning the slats. Then the right and left turning screw housings 4 and 5, together with the screw guide plates 8, cut the blades first, push them to the side by a distance of bz and turn them to the vertical position, i.e. 900. After that, it lays on the egates formed by double hulls under the influence of hulls and guides. After that, pushers 7 push the slats on the surface of the field and place them on the edge formed by the bodies 4 and 5. This is how flat plowing is done. Plug's suspension device is intended for use with tractors of class 4 and 5. Disk blades and support wheels are serially produced. The mechanism for adjusting the plug support wheels allows you to change the depth of the plow within the limits of 22-27 cm.

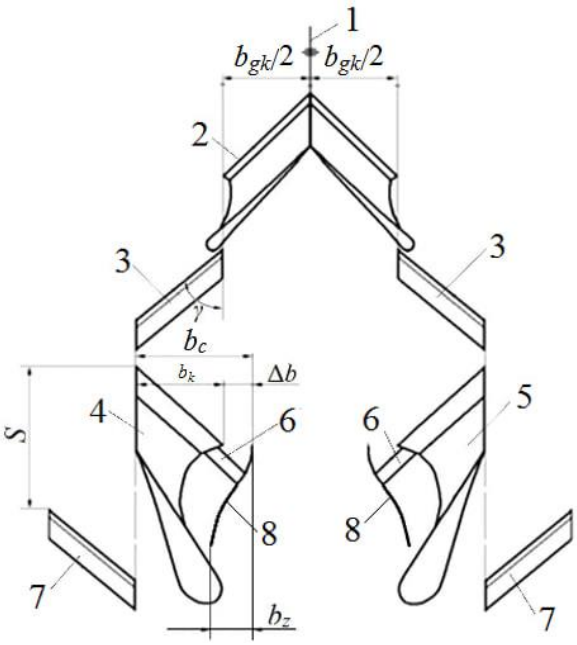

Figure 3. The scheme of plowing without a plow: 1 - disk-shaped knife;

2 – double hull; 3 – front thrusters; 4 and 5 - housings that turn to the right and left; 6 – additional plow; 7 – rear pusher; 8 - router.

Figure 4 shows the general view of the plow PT-4-45, which is developed in closed and semi-open cutting conditions.

Figure 4. An experimental copy of a flat plow plow without an edge in closed and semi-open cutting conditions

The results obtained from the tests are presented in Table 2.

As can be seen from the above table, all the quality indicators of the flat plow without an edge in the conditions of closed and semi-open cutting fully meet the requirements of agrotechnics. In the tests, in the conditions of closed and semi-open cutting, the edgeless flat plow reliably performed the specified technological process, and its serious defects were not observed. The agrotechnical indicators of the experimental copy of plow plowing plow without edge in conditions of closed and semi-open cutting are almost the same as those of PLN-5-35 plow. However, when using the experimental copy of this plow on farms, fuel consumption per hectare is 4.31 kg less than that of the PLN-5-35 plow.

Table 2. Test results of plow plow without edge

№	Indicator name	Value of indicators		
		According to the initial requirements	According to the test results	
			PLN-5-35	FP-4-45
1.	Speed of movement, km/h	6-8	7,51	7,62
2.	Coverage: M_{ave} cm ±σ, cm *v*, %	 ±10 cm <10	 177,4 6,7 3,77	 183,2 3,2 1 ,75
3.	Driving depth:			
	M_{ave}, cm ±*σ*, cm *v*, %	25 - <10	25,1 1,89 7,53	24, 3 1, 81 7,45
4.	Burial completeness of plant remains, %	>90	93,9	92, 4
5.	Burial depth of plant remains: M_{ave}, cm ±*σ*, cm	 >10	 12,7 3,2	 12, 1 2,9
6.	Amount of the following size fractions, % >50 mm 50-25 mm	 < 10 > 5	 5,8 13,1	 5, 1 12,5

	<25 mm		81,1	82, 4
7.	Comparative fuel consumption, kg/ga	-	25,52	21, 21

Conclusion. Developed on the basis of the conducted researches, the plow with a flat plow reliably performed the specified technological work process, and its performance fully corresponds to the agrotechnical requirements and the technical assignment.

Fuel-lubricants are reduced by 21.26% when plowing the land using the developed flat plow plow. This allows for economic benefits.

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