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Research Results on the Basis of Combined Aggregate Softener Work Surface

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The article presents the results of the research on the technological work process of the softener, which is the main working organ of the resource-saving combined unit for growing cotton, and the justification of its working surface. According to the results of the conducted theoretical and experimental research, it was shown that the shape of the softener's working surface should be convex in order to soften the soil with high quality and low energy consumption.

Keywords: Combined aggregate, softener, technological work process, working surface, movement speed, column, beam, experimental research, experiment, flat, concave and convex.

1. Introduction

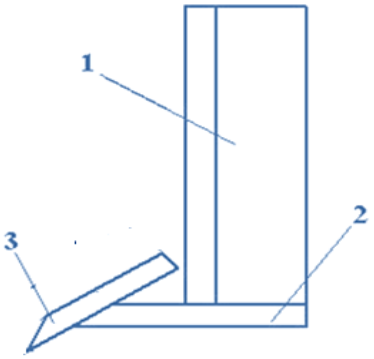
In the irrigated cotton-growing regions of our republic, the existing technologies of land preparation for growing cotton in cotton fields consist of technological processes such as fertilizing, plowing, chipping, harrowing, grinding, cotton picking, which are performed with separate aggregates. tractors and agricultural machines and tools are used. This, in turn, leads to an increase in labor, fuel, and other material costs, as well as multiple passing of aggregates through the field, damage to the soil structure, and densification of the subsoil layer [1].

According to the conducted researches, 1.5-2.0 times less energy and fuel consumption is required for soil tillage than plowing. The quality of processing improves (due to the absence of unevenness, large lumps), productivity increases. In addition, tillage machines and tools have low metal volume compared to plows, relative resistance, high productivity, are easy to use, and on their basis, it is possible to create comprehensive and combined aggregates. [1,2].

2. Research method.

Based on the results of the research, a resource-saving combined unit was developed for growing cotton in cotton fields [2,3]. The main working units of the combined unit are a softener that softens the soil without overturning it, a fertilizing device for fertilizing the softened layer in a tape-like manner, and dust collectors that form dust on the softened and fertilized layer.

The combined aggregate softener (Picture. 1) consists of column 1, rammer 2 and needle-shaped softener 3, and serves to loosen the last year's egate at a depth of 30-40 cm without turning it over. [1].



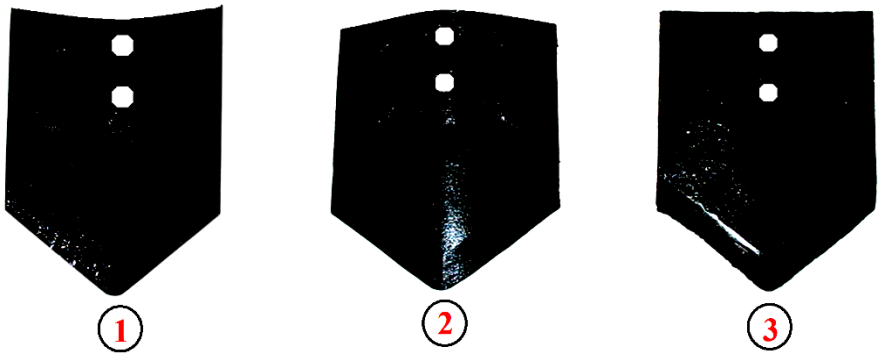
1-Column; 2- rammer; 3- awl-shaped softener

Picture 1. Softener of combined aggregate

We present the results of research conducted on the basis of the shape of the softener working surface, which is one of the main parameters of the softener.

To conduct experimental studies, the design of the combined unit was developed and its experimental copy (Picture. 2) and softeners with different geometric shapes of the working surface (Picture. 3) were prepared. [4]

Picture 2. Experimental copy of the combined aggregate



Picture 3. Softeners with concave (1), convex (2) and flat (3) working surfaces

Before conducting the experiments, soil moisture, density and hardness were determined. These parameters were studied in layers of 0-10, 10-20, 20-30 and 30-40 cm in egat, pushta and chok rows.

When conducting the experiments, the tensile strength of the working bodies, the quality of soil compaction, the width and depth of the softened layer were accepted as evaluation criteria.

These indicators are UzSt 3355:2018 [5]. Testing of agricultural machinery. Machines and tools for deep tillage. It was determined using the program and methods of tests.

The quality of soil compaction was determined by dividing the softened layer and soil samples from the pit into fractions larger than 100 mm, 100-50 mm, and smaller than 50 mm using a bottomless box of 0.5x0.5x0.2 m. For this, the samples were passed through sieves with the diameter of the holes 50 and 100 mm. [7] The obtained results were calculated as a percentage of the total mass of the soil, and the quality of soil compaction was determined.

The softened layer width B was measured on the cross-sectional profile of the treated layer with an accuracy of ±0.1 cm.

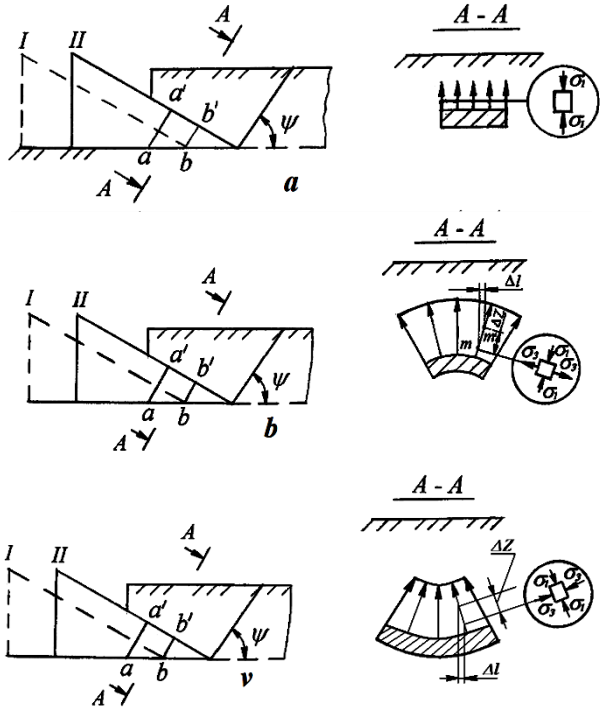
The depth of the softened layer was determined by dipping a ruler with a cross-sectional area of 1 cm2 into the trace of the softener. Measurement accuracy is ± 0.5 cm, repeatability equal to 25 times.

Traction resistance of combined aggregate working bodies and UzSt 3193:2017. Testing of agricultural machinery. It was determined using a field dynamometric device using the tensometric method according to the method of energy evaluation of machines.

3. Research results.

Chisel-cultivator, deep softener and other machines used for soil cultivation in cotton cultivation are mainly equipped with working bodies having a flat working surface. Under the influence of such a force (Picture. 4, a), the soil is compressed (crushed) in the direction perpendicular to its surface until it crumbles, and when the compression reaches the strength limit, the soil breaks (breaks) at an angle ps to the direction of movement, and a prism-shaped cut is formed from it. separated. [8] If the surface of the working body has a curved shape in the transverse-vertical plane, it is subjected to compression and other deformations until it

breaks.



Picture 4. Deformation of the slab under the influence of softener with flat (a), convex (b) and concave (v) surfaces

For example, if the surface of the working body is convex (Picture. 4, b), the blade stretches along with compression in the transverse view, that is, under the influence of the working body, the point m of the blade is compressed by a distance z and (It extends to a distance of l.)

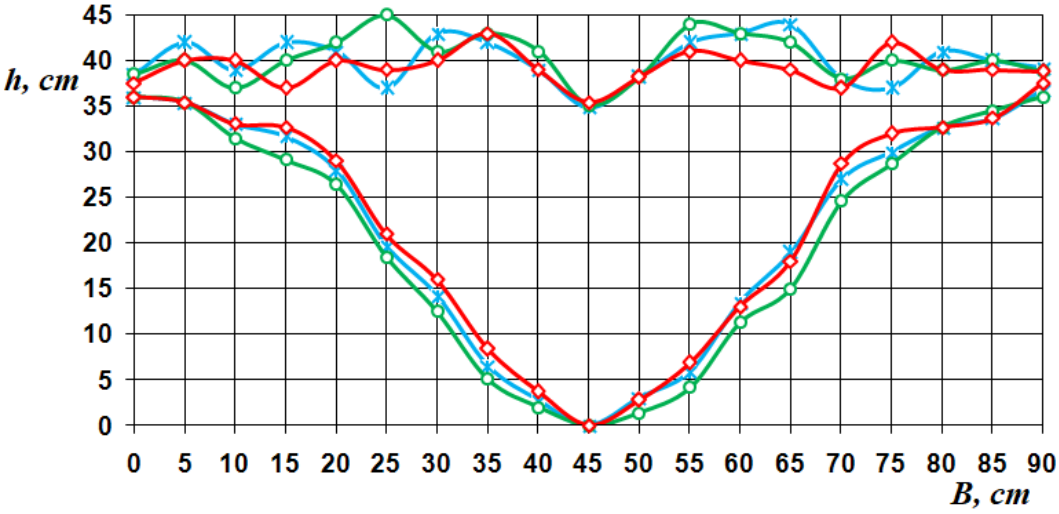
If the surface of the working body has a concave shape (Picture. 4.v), the blade is compressed both in the direction perpendicular to the working surface and in the transverse direction (this compression is equal to (z and (l), respectively, for point m of the blade). [9] This o It is self-evident that it leads to an increase in energy consumption in tillage.

So, in order to ensure high-quality compaction of the soil with low energy consumption, the working surface of the softener should be convex.

Comparative test results of softeners with different working surfaces. Based on the conducted theoretical studies, softeners with flat, concave and convex working surfaces were made and tested. Tests were conducted at speeds of 6.0 and 8.0 km/h.

In the experiments, all the parameters of the working bodies except the working surface were the same: width-140 mm, length 150 mm, and the angle of entry into the soil - 30°, the depth of processing - 35 cm. The radius of curvature of softeners with concave and convex surfaces was assumed to be 240 mm.

The results of the experiment are presented in Picture 5 and in the table.



Picture 5. It is flat when the aggregate speed is 6.0 km/h (—x—x—), concave (—◇—◇—) and convex (—○—○—) cross sections of the zone softened by surface softeners

The data obtained from the experiments showed that the results of the conducted theoretical studies were correct, that is, the working body with a convex working surface had less resistance to traction compared to other working bodies, and the soil compaction quality was high. The reason for this is that, as shown in theoretical studies, under the influence of the working body with a convex surface, the soil is stretched in the transverse direction, in addition to compression in the direction of movement. [10] This leads to a decrease in the soil's resistance to fragmentation and, therefore, to the drag resistance of the working body and to the improvement of its compaction quality.

Results of comparative tests of softeners with different working surfaces

The type of surface of the working body	Working speed, km/h	Softened layer depth, cm		Amount of size fractions (mm) below, %			To pull was resistance kN
		M_{av}	±σ	> 100	100-50	>50	
flat	6,0	36,2	1,08	17,47	10,40	72,13	11,46
	8,0	34,9	1,62	9,64	13,67	76,69	12,56
concave	6,0	37,7	1,21	14,50	12,10	73,40	11,63
	8,0	35,4	1,71	11,20	12,97	75,83	12,62
convex	6,0	35,7	1,19	10,20	12,85	76,84	10,41
	8,0	35,1	1,42	9,48	10,85	79,67	11,27

As can be seen from the table, an increase in the movement speed leads to an increase in the traction resistance of the working bodies and an improvement in the quality of soil compaction, that is, a decrease in the fractions with a size larger than 100 mm, and an increase in those smaller than 50 mm in size. brought

The main reasons for this are the increase in the inertia of the soil on the working bodies and the impact forces exerted on the soil by the working bodies with the increase in speed.

It should be noted that as the speed increased from 6.0 km/h to 8.0 km/h, the traction resistance of the convex surface working body changed little compared to the flat and concave working bodies.

For example, when the speed changes within the specified limit, the traction resistance of the working bodies with a flat and concave surface increased by 1.10 and 0.99 kN, respectively, while that of the working body with a convex surface increased by 0.86 kN. This can also be explained by the reduction of the soil's resistance to fragmentation due to the stretching of the soil in the transverse direction under the influence of the working body with a convex surface.

In addition, it can be seen from the analysis of the obtained data that the geometric shape of the working surface of the softener did not have a significant effect on the depth of the softened layer, but with the increase in speed, a slight decrease in this indicator was observed in all softeners.

So, on the basis of theoretical and experimental studies, it can be noted that the working surface of the softener should be convex in order to ensure high-quality crushing of the soil with low energy consumption.

4. Summary.

1. According to the conducted studies, 1.5-2.0 times less energy and fuel consumption is required for soil tillage than plowing. The quality of processing improves (due to the absence of unevenness, large lumps), productivity increases.

2. Based on the results of the conducted research, a resource-saving combined unit was developed for growing cotton in the field.

3. Theoretical and experimental studies, in order to ensure high-quality grinding of soil with low energy consumption, the working surface of the softener should be convex.

References

1. AN Khudoyarov. Combined aggregate for minimum processing. // Technique in agriculture. Moscow//. Volume 6. pages 56-57. 2009.
2. TS Khudoyberdiev, AN Khudoyorov. New method of soil cultivation and technical device for its implementation // Proceedings of the int. scientific-practical. conf. Actual issues of agrarian science and education // vol. 4.2018.
3.Xudoyorov Anvarjon Nazirjonovich, Mamadaliev Maxammadjon Xabibullayevich, Muradov Rahimjon Xakimjonovich, Yuldasheva Matluba Ashuraliyevna. Power-efficient method of

tillage and its technology model. //European science review.// 1-2 .page 212-214.2017
4. Tokhtakoziyev, A., Khudoyarov, A., Nazirjanov, I., & Yuldasheva, M. (2023). Study on the selection of the type and parameters of moldboard plow for combined tillage system. In E3S Web of Conferences (Vol. 377, p. 03002). EDP Sciences. http://doi.org/10.1051/e3sconf/202337703002
5. UzSt 3355:2018. Testing of agricultural machinery. Machines and tools for deep tillage. It was determined using the program and methods of tests-Toshkent, 2018. – 70 b.
6. Panov I.M., Suchkov I.V., Vetokhin V.I. Questions of the theory of interaction of the working organs of a deep-digger with the soil // Research and development of tillage and seeding machines: Collection of scientific papers - Moscow, VISHOM, 1988, -P. 43-61.
7. Khudoyarov, A., Abdimominov, I., & Yuldasheva, M. (2023). Theoretical researches which are conducted on the precise dimensions of the furrow maker. In E3S Web of Conferences (Vol. 452, p. 01043). EDP Sciences. http://doi.org/10.1051/e3sconf/202345201043
8. Xudayarov, A., Nazirjonov, I., Abdimominov, I., & Yuldasheva, M. (2024). Investigating the rationale of dimensional elements in the ripper of a combined unit. In E3S Web of Conferences (Vol. 497, p. 03024). EDP Sciences. http://doi.org/10.1051/e3sconf/202449703024
9. Mirzaev, I., Zulunov, Z., Abdimominov, I., & Yasharov, M. (2024). Study of the operating parameters of fuel equipment units of MTZ-80x tractors in natural and climatic conditions of the republic of Uzbekistan. In E3S Web of Conferences (Vol. 587, p. 01027). EDP Sciences. https://doi.org/10.1051/e3sconf/202458701027
10. Mirzaev, I., Zulunov, Z., Abdimominov, I., & Yasharov, M. (2024). Analysis of losses in the storage of pure oil products stored in agrocluster oil warehouses and devices for their disposal. In BIO Web of Conferences (Vol. 141, p. 02024). EDP Sciences. https://doi.org/10.1051/bioconf/202414102024