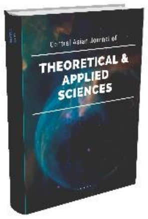

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Method of Determination of Traction Resistance of Combined Aggregate Software and Results Received

A. N. Khudoyarov
Professor

M. A. Yuldasheva
Independent Researcher, Andijan Institute of Agriculture and Agrotechnology

I. Nazirjonov
Basic doctorant, Forestry Research Institute

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Abstract: *The article presents a method for determining the tensile strength of a combined aggregate softener and the results obtained. Based on the results, it was found that the width of the softener at a speed of 1.7-2.2 m / s to soften the soil at the level of agro-technical requirements with low energy consumption is in the range of bю=140mm, the angle of entry into the soil αю= 30-350 and the length of the working surface Lю= 150-200mm.*

Keywords: *Combined aggregate, softener, traction resistance. minimum tillage, soil compaction rate, strain gage, dynamometric device, test, soil deformation, softener width, length, soil penetration angle.*

Introduction. In the studies [1–5], a combined aggregate with minimal tillage was developed for cotton cultivation in cotton. With the help of the proposed combined aggregate, the fields freed from the cotton crop will be softened and fertilized inside the irrigated fields of the previous season, and in these softened and fertilized areas new seedlings will be formed for sowing next year.

The proposed aggregate will loosen the inside of last season's irrigated fields of cotton fields cleared and stripped of cotton stalks at a depth of 30-40 cm without overturning. , 25-30 cm in height, new shoots are formed, ie soft and fertilized shoots are formed in place of last season's shoots, and shoots are formed in place of shoots.

The proposed technology significantly reduces the consumption of labor, energy and fuels due to the softening of roads without tillage and the absence of storming, plowing and chiseling, a sharp reduction in the number of field trips (from 6-7 to 2 times). became known. In addition, since the seeds are softened, fertilized and piled and planted in areas not pressed by tractor motors, they create favorable conditions for even germination, good plant growth and high yields.

Combined unit [1,5,6] is a frame (1) on which the working bodies are installed and allows them to be adjusted at different distances and depths, a unit for hanging the unit on a tractor (2), a deep softener (3), a baler (4), a fertilizer hopper (5), consisting of a fertilizer spreader (6) and a support wheel (7).

The main working bodies of the combined unit are a softener that softens the soil without overturning, a fertilizer device for fertilizing the softened layer in a ribbon-like manner, and cotton pickers that form piles on the softened and fertilized layer.

Research methods. Resistance to traction of the combined aggregate softener UzDSt 3193: 2017. “Testing of agricultural machinery. The method of energy evaluation of machines "was determined by the strain gage using a field dynamometer [10].

The dynamometer (Fig. 1) consists of a frame 1, an adjuster 2, a working body (softener) 3 and a support sledge 4. The working body 3 is mounted on the frame by means of gryadil 5 and connected to the strain gage 6 by means of a length-adjustable link 7.

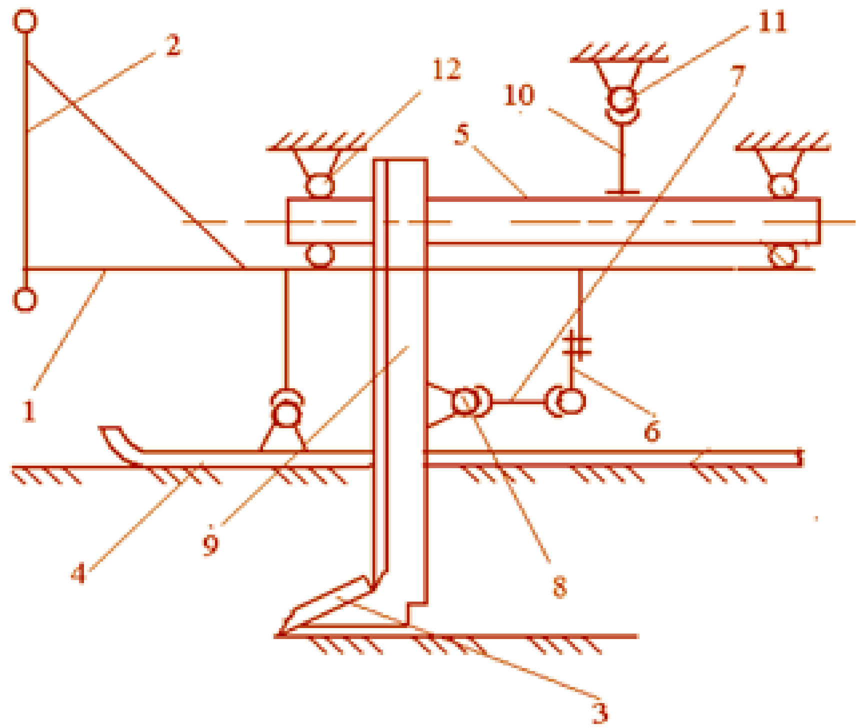

Figure 1. Schematic of a dynamometric device that determines the traction resistance of combined working bodies

Gryadil 5 is mounted on frame 1 by means of ball bearings 12, which are able to slide and rotate on the X – X axis. The column of working bodies is rigidly fastened to 9 gryadil 5, which is held by the lever 8 and the drawbar 10 without rotating around the longitudinal X - X axis. At both ends of the link 7 and the drawbar 10, ball bearings 11 and 12 are mounted, which ensure that the resistance force acting on the working body is transmitted directly to the strain gage. Strain gauge 6 is made of steel grade 40X, its cross-sectional area has a rectangular shape measuring 30x80 mm. Two PKB-20–200 strain gages are attached to the working surface of the strain gage.

The depth of immersion (tillage) of the working bodies is adjusted by lifting and lowering the base sledge 4 by means of a screw mechanism. It is 2.1 m long and 30 cm wide, which ensures that the depth of immersion of the working bodies in the soil on uneven surfaces is kept flat. The advantage of this device is the ability to scan the strain gage without disassembling it.

Before and after the experiments, the strain gauze was weighed.

Weighing of the strain gauze (Fig. 2) was carried out using a standard dynamometer 11 DOSM-3-1. In this case, the working body is loaded by means of a drawbar 10 and a screw 12. Loading was in the range of 0–14kN for the softener and 0–10 kN for the pulse receiver every 2 kN interval.

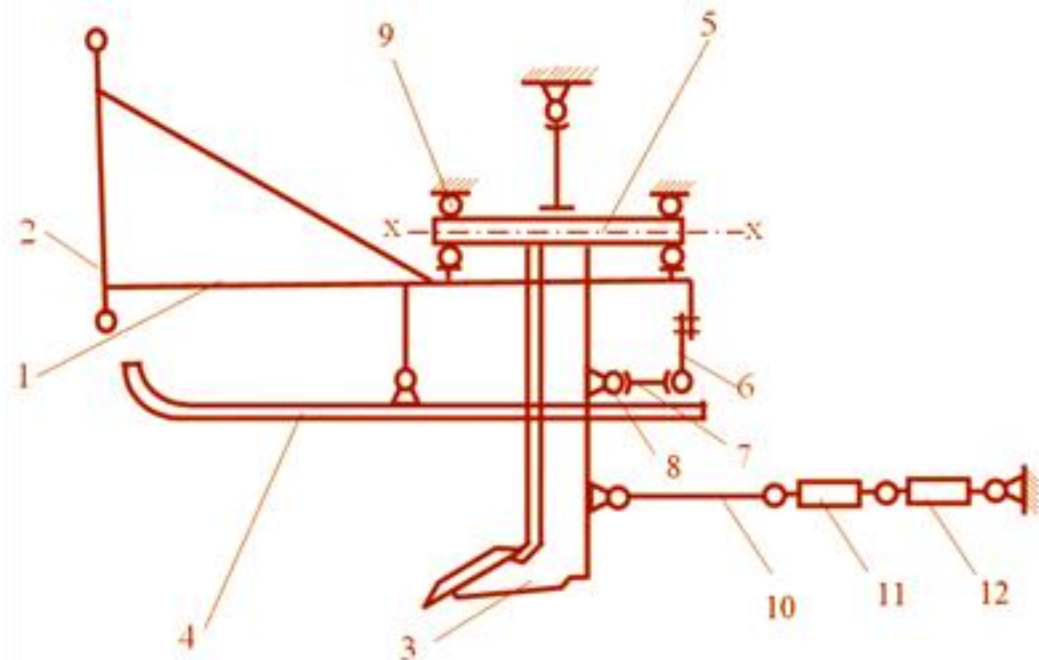

Figure 2. Dynamometric device strain gage scheme of making

According to the data obtained from the survey, the coefficient of the survey was determined. The experimental data were then multiplied by the traction coefficient to determine the true value of the resistance force exerted by the soil on the working body. Tariff error was at most 2.6%.

The results of the study. During the tensometry, the dynamometer was aggregated with a tractor *CLASSARES697ATZ,* the force acting on the working body was recorded.

Mathematical statistical methods were used in the experiments to determine the arithmetic mean values and standard deviations of the indicators [10,11].

Multi-factor experiments were performed using the method of mathematical planning of experiments to determine the combined optimal values of the parameters studied in theoretical studies and single-factor experiments of the softener [11].

The table shows the factors, their conditional designation and the range of variations. They were determined based on the results of theoretical research and one-factor experiments [12,13].

Factors, their conditional designation, variation interval and level

Naming of factors	Unit of measurement	Marking	interval	Level of factors		
				-1	0	+1
1. The width of the softener	*mm*	X_1	60	100	140	180
2. The angle of penetration of the softener into the soil	*grad*	X_2	10	20	30	40
3. The length of the softening work surface	*mm*	X_3	50	150	200	250

4. The speed of movement of the unit	*m/s*	X_4	0,5	1,5	2,0	2,5

In the multi-factor experiments, the evaluation criteria were the degree of soil compaction, ie the amount of fractions smaller than 50 mm, the width of the soil deformation zone and the tensile strength of the softener.

The experiments were performed using a table of random numbers and the processing depth for all variants was set at 35 cm.

The experimental data were processed using a "regression analysis" program developed in the Experimental Planning Laboratory of the Agricultural Mechanization Research Institute [11]. The Cochrane criterion was used to assess the homogeneity of the variance, the Student's criterion was used to assess the value of the regression coefficients, and the Fisher criterion was used to assess the adequacy of the regression models.

The results of the experiment were processed in the specified order and the following regressive equations were obtained, which adequately describe the evaluation criteria:

a) by the degree of soil compaction (%)

Φ=80,672-2,731X_1+2,392X_2+2,595X_3+1,870X_4; (1)

b) along the width of the soil deformation zone (cm)

B=72,584+5,703X_1+2,785X_2+2,733X_3-1,746X_4-3,824X_2^2; (2)

c) attenuation resistance of the softener (kH)

R=10,744+2,428X_1+1,110X_3+2,302X_4+0,240X_1X_2+0,259X_1X_3+0,243X_1X_4–0,269X_2X_3-0,262X_2X_4-0,422X_3X_4-0,733X_1^2+0,861X_2^2+0,849X_4^2.

The analysis of the obtained regression equations shows that all factors had a significant impact on the evaluation criteria. The increase in the width of the softener led to a decrease in the degree of soil compaction, an expansion of the soil deformation zone and an increase in the traction resistance of the working body. With the increase of the angle of penetration of the softener into the soil, the degree of soil erosion and the width of the deformation zone increased first (up to 30-35^0), then began to decrease, the resistance of the working body to gravity decreased first, then increased.

The increase in the length of the softening working surface led to an increase in all parameters. With increasing speed, the degree of soil compaction and the resistance of the working body to gravity increased, and the width of the soil deformation zone decreased.

The regression equations (1), (2) and (3) are solved on the condition that the criterion "F" is not less than 80%, the criterion "B" is the maximum, and the criterion "R" is the minimum, and the aggregate is 1.7-2.2 m / s velocities were found to be in the range of $b_{ю}$=140mm, $\alpha_{ю}$=30-35^{0}and $L_{ю}$=150-200mm.

Conclusion.

1. The increase in the width of the softener has led to a decrease in the degree of soil compaction, the expansion of the zone of soil deformation and an increase in the traction resistance of the working body.
2. The increase in the angle of penetration of the softener into the soil increased the degree of soil erosion and the width of the deformation zone before (30-35^0), then began to decrease, the resistance of the working body to gravity decreased, then increased.
3. The increase in the length of the softening working surface has led to an increase in all parameters.

4. With the increase in speed, the degree of soil compaction and the resistance of the working body to gravity increased, the width of the soil deformation zone decreased.
5. The calculations revealed that at a speed of 1.7-2.2 m / s of the unit, the width of the softener is in the range of $b_{ю}$=140mm, the angle of entry into the soil is $\alpha_{ю}$= 30-350 and the length of the working surface is $L_{ю}$= 150-200mm.

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