

## THE INFLUENCE OF THE OPENING ANGLE OF THE SOIL PUSHER OF THE COMBINED MACHINE LEVELER ON ITS PERFORMANCE

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**Abstract.** The article presents the results of experimental research on the influence of the opening angle of the soil pusher of the combined machine leveler used in the preparation of land for planting on the performance indicators of the leveler.

**Key words:** combined machine, leveler, parallelogram mechanism, soil spreader, opening angle of soil spreader, mean square deviation of heights of unevenness on the field surface, level of soil compaction, relative resistance to traction.



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**INTRODUCTION.** Currently, in our country, land preparation for sowing seeds is carried out separately many times by means of medium and heavy toothed harrows, chisel-cultivators and various levelers [1]. However, this leads to deterioration of the physical and mechanical properties of the soil, a lot of moisture loss from the soil, and an increase in fuel consumption and other costs. In addition, the machines used for tillage before planting do not meet modern requirements such as minimal and economical tillage. Based on the above, in the scientific-research institute of agricultural mechanization, in the cultivation of cotton, grain and other agricultural crops, all technological processes are performed in one pass through the field for processing the land before planting, that is, the land is designated A combined machine has been developed that can soften to depth, create a soft soil layer on the surface of the field, level it, and ensure its compaction to the required level. The machine consists of a frame, a suspension device installed on it, support wheels and working bodies, which, depending on the process to be performed, consist of a softener and bullet-shaped claws, a leveler and a plate roller, which are placed in a row on the frame [2, 3].

### ANALYSIS AND METADODOLOGY OF ANTIQUITIES

The leveler of the combined machine consists of a leveling part 2 connected to the frame by means of parallelogram mechanisms 1 equipped with a pressure spring and soil pushers 3 installed in its front part. It pushes the soil of the unevennesses to the side, i.e. in the transverse direction, filling their edges, and the leveling part pushes the unevennesses found in the longitudinal direction to the depressions. As a result, the leveling of the surface of the machine-treated layer in the longitudinal and transverse directions is ensured at the required level and evenly [4].

In the article UzDSt 3412:2019 "Testing of agricultural equipment. Machines and tools for soil surface treatment. Test program and methods" and UzDSt 3193:2017 "Testing of agricultural machinery. "Method of energy assessment of machines" regulatory documents were used [5-6], and experimental studies were conducted.

### DISCUSSION

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In the experiments, the opening angle of the soil pusher of the combined machine leveler  $\alpha$  is the mean square deviation ( $\pm\sigma$ ) of the heights of irregularities on the field surface, the level of

soil compaction ( $F < 25$ ), that is, the amount of soil fractions with a size smaller than 25 mm, and the relative traction resistance  $R_c$  of the combined machine, i.e., its effect on the traction resistance per meter of coverage width, was determined.

Based on the results of theoretical studies carried out in experiments, this angle was changed from  $50^\circ$  to  $80^\circ$  in every  $10^\circ$  interval. This was achieved by changing the soil pushers made with different opening angles (Fig. 1). In this case, the angle of deviation of the longitudinal pulls of the leveler parallelogram mechanisms relative to the horizon is  $0^\circ$ , the longitudinal distance between the softener and the leveler is 25 cm, the height of the soil pusher is 14 cm, the vertical load applied to each meter of the leveler's coverage width is 600 N/m, and the speed of the unit is 6 and 8 km/h were determined.

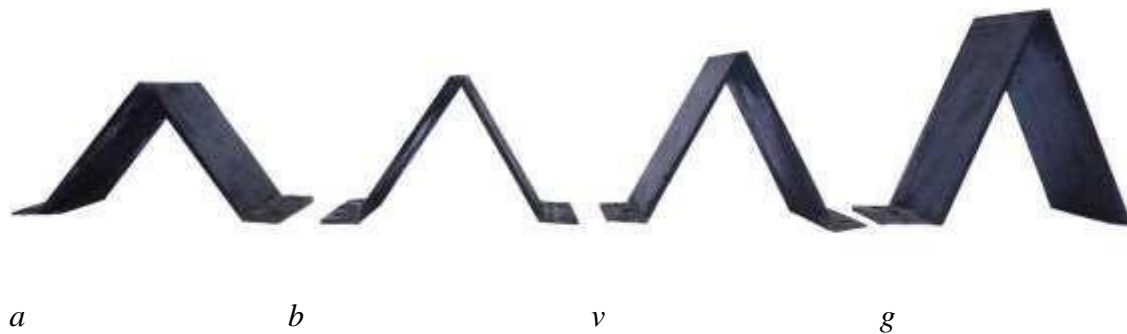


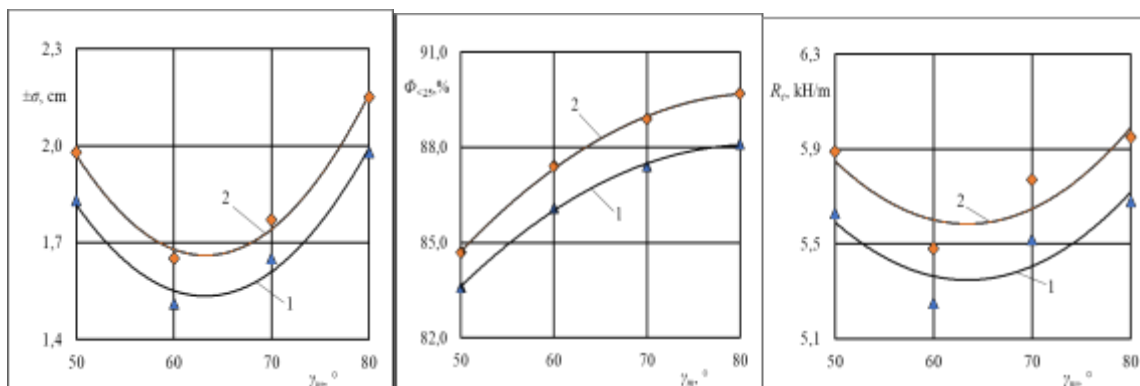
Figure 1. Soil pushers with an opening angle of 80 (a), 70 (b), 60 (v),  $50^\circ$  (g)

The results obtained in the experiments are presented in Figure 2.

A mathematical method of planning experiments was used to optimize the parameters of the rectifier. Experiments were conducted on the basis of a four-factor plan [70; pp. 242-243, 71; pp. 195-196].

Arithmetic average values and average square deviations of indicators were determined using mathematical statistics methods [72; pp. 182-192, 73; pp. 101-108, 74; pp. 95-99].

**THE RESULT.** Their analysis shows that with an increase in the opening angle of the soil pusher, the mean square deviation of the heights of irregularities on the field surface changed according to the law of a concave parabola (first decreased, then increased) at both movement speeds. According to the results of theoretical studies, this is explained by the fact that when this angle is in the range of  $27-30^\circ$ , the time of contact of the soil pusher with the soil is minimal, and as a result, the soil does not stick to the working surface of the soil pusher and does not stick in front of them.



1 and 2 when aggregate speed is 6 and 8 km/h, respectively

Figure 2. The influence of the opening angle of the soil pusher of the combined machine

### leveler on its performance

Increasing the opening angle of the combined machine leveler from 50° to 80° led to an increase in the amount of soil fractions smaller than 25 mm in size. But the speed of increase decreased with the increase of the opening angle of the soil pusher.

As the opening angle of the soil pusher increased from 50° to 60°, the relative drag of the combined machine decreased even at aggregate movement speeds of 6 and 8 km/h. Increasing this angle from 60° to 80° has led to an increase in the relative resistance to traction of the combined car. This is desirable for the reasons given above.

The graphical relationships presented in Figure 2 can be expressed by the following empirical formulas determined by the above-mentioned methods:

a) when the aggregate movement speed is 6 km/h:

$$\pm\sigma = 0,0016 \gamma_t^2 - 0,2054 \gamma_t + 8,0215 \quad (R^2 = 0,9712); \quad (1)$$

$$F_{<25} = -0,0045 \gamma_t^2 + 0,733 \gamma_t + 58,23 \quad (R^2 = 0,9985); \quad (2)$$

$$R_c = 0,0013 \gamma_t^2 - 0,1713 \gamma_t + 10,782 \quad (R^2 = 0,7389) \quad (3)$$

b) when the aggregate movement speed is 8 km/h:

$$\pm\sigma = 0,0018 \gamma_t^2 - 0,2244 \gamma_t + 8,7555 \quad (R^2 = 0,9878); \quad (4)$$

$$F_{<25} = -0,0048 \gamma_t^2 + 0,7825 \gamma_t + 57,475 \quad (R^2 = 0,9991); \quad (5)$$

$$R_c = 0,0015 \gamma_t^2 - 0,187 \gamma_t + 11,515 \quad (R^2 = 0,7493), \quad (6)$$

in this  $\gamma$  –the transverse distance between the teeth of the device,cm.

**CONCLUSION.** Based on the above, it is desirable that the opening angle of the soil pusher of the combined machine leveler should be  $60^\circ$ .

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