ISSN NO: 2770-0003
Date of Publication: 12-09-2022

# The Substantiation of the Parameters of the Working Body of the Improved Mala-Leveler

**Ortikov Nozimjon Boqijon ogli**
Senior Teacher, Ph.D.
Namangan Engineering Construction Institute

**Abstract:** In the article, analytical dependencies are obtained, which allow to determine the rational values of the parameters of the working organ (alignment angles to the horizon and sealing parts, the length of the working surface of the sealing part, the height of the working member and the vertical load on it), and the racists are shown to be obtained from them.

**Key words:** Mala-leveler, working body, aligning part, sealing part, the installation angles to the horizon of the leveling and sealing parts, length of the working surface of the sealing part. The height of the working element and the vertical load on it.

**Introduction:** Today, the production and use of energy-resource-efficient, high-performance aggregates, which are processed before planting in the soil, in the cultivation of agricultural crops in the world is taking a leading place. "Currently, the cultivated area in the world before planting is 1.6 billion. hectare" it is necessary to pay special attention to the creation and development of energy-resource-efficient aggregates with high work quality and productivity, which are used in the cultivation of land before planting.

High-quality tillage of the land before planting is important for growing abundant crops from agricultural crops. Because if the land is not treated with quality before planting, the seeds of agricultural crops cannot be sown at the level of agrotechnical requirements, the sown seeds will not germinate, and the necessary seedlings will not be obtained from each hectare. This, in turn, leads to a decrease in crop productivity.

It is known that the main task in tilling the land before planting is to level the surface of the fields, to compact them to the required level, and to crush the large lumps in it to form a soft soil layer [1]. Currently, MV-6.0, MV-6.5 and other levelers available on farms are widely used for this purpose in our country [2,3]. But when using these levelers, they need to go through the same place two or three times in order to treat the land at the required level. This leads to increased labor and other costs for preparing land for planting, including fuel consumption, excessive soil compaction and moisture loss, reduced productivity, and longer planting periods for agricultural crops. In addition, the existing levelers are morally outdated, do not meet modern requirements such as minimal and economical land treatment. Based on these, the Scientific-Research Institute of Agricultural Mechanization and Electrification has developed an improved grinder-leveler, and studies are being conducted to justify its parameters.

Methodology of research: The results of the theoretical studies conducted on the basis of the parameters of the grinder-leveler working body, which works on the land before planting, are presented. The research was conducted using the basic theory of agricultural mechanics and the fundamental laws and rules of theoretical mechanics and higher mathematics.

Research results: Before planting in the land, the working body of the mill-leveler consists of leveling and compacting parts (Fig. 1), the following are its main parameters affecting agrotechnical and energetic performance.

a, b - the angles of installation of the leveling and densifying parts of the working body relative to the horizon, respectively;

L - the length of the compacting part of the working body;

H- the height of the working body;

Q- the vertical load applied to the working body.

ISSN NO: 2770-0003
Date of Publication: 12-09-2022

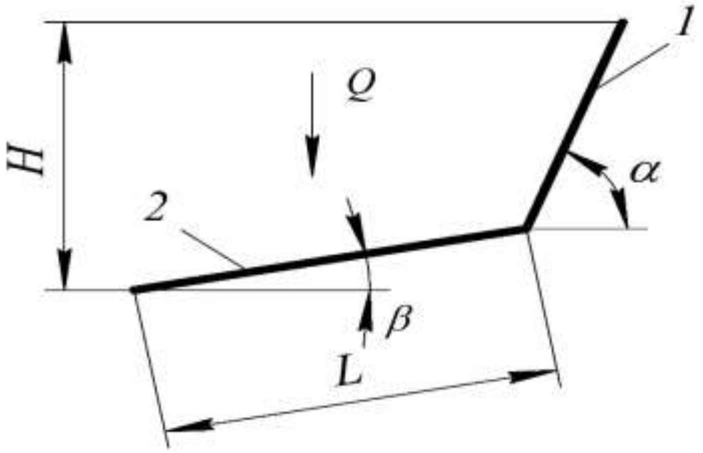


Figure 1. The working body of the roller-leveler: 1,2-leveling and compacting parts, respectively

To determine the angle of installation of the leveling part of the working body relative to the horizon, we consider the forces acting on the soil pieces by it (Fig. 2).

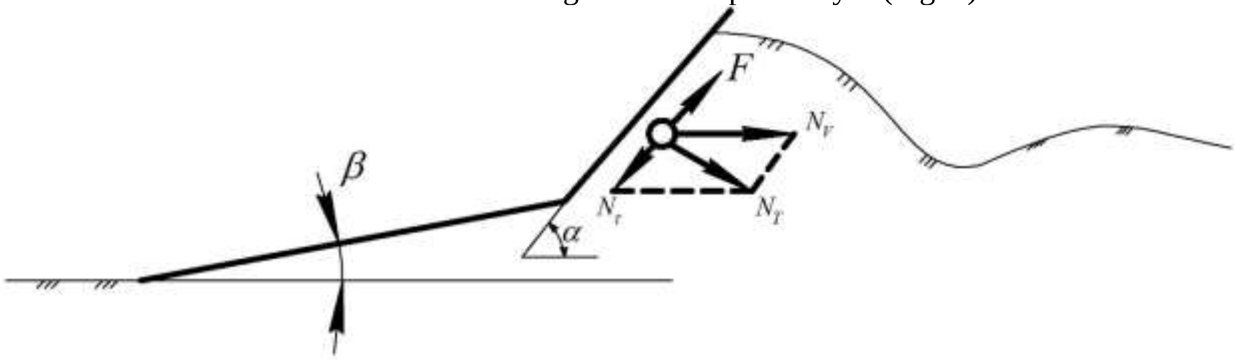


Figure 2. Scheme for determining the angle of installation of the leveling part of the working body relative to the horizon.

During the work process, normal N and friction F forces are applied to the soil pieces by the leveling part. We divide the force N acting on the piece of soil into the forces Nv and N□ directed along the direction of movement and the working surface of the leveling part, and based on the scheme in Fig. 2, we get the following results

$$N_V = \frac{N}{\sin\alpha} \quad (1) \qquad \text{ва} \qquad N_\tau = Nctg\alpha . \quad (2)$$

Here, the force Nv moves the soil particles forward, and the force N□ moves them downward. In order to ensure quality leveling of the field surface, the following condition must be met

$$N_\tau < F . \quad (3)$$

Otherwise, i.e., if Nt > F, the soil particles will sink into the soil without being pushed forward sufficiently. As a result, the field surface is not leveled with sufficient quality.

Considering expression (2) and F=Ntgph (where φ is the angle of friction of the working surface of the working body leveling part of the soil), expression (3) has the following form

$$ctg\alpha < tg\varphi . \quad (4)$$

Solving this expression with respect to a, we get the following result

$$\alpha > 90 - \varphi . \quad (5)$$

ISSN NO: 2770-0003
Date of Publication: 12-09-2022

Putting the values of φ known from the literature (30-35º) into this expression [4], we determine that the angle of installation of the leveling part of the working body with respect to the horizon should be at least 60º.

We determine the angle of installation of the compacting part of the working body relative to the horizon based on the condition that the time of interaction between it and the soil pieces is minimal [5]. Because in this, first of all, the compacting part of the working body of the soil

it is prevented from sticking to the working surface and sticking to the work body, and secondly, the technological process is performed with minimal energy consumption.

According to the scheme presented in Fig. 3, we determine the time of contact of the compacting part of the working body with soil particles

$$t = \frac{h_o}{V_c \sin\beta} = \frac{h_o}{V_м(\cos\beta - f\sin\beta)\sin\beta}, \qquad (6)$$

where h0 is the depth of submergence of the compacting part of the working body into the soil, m;
Vc is the sliding speed of the soil lump on the working surface of the compacting part of the working body, m/s.

Vm is the speed of the working body in forward movement, m/s;

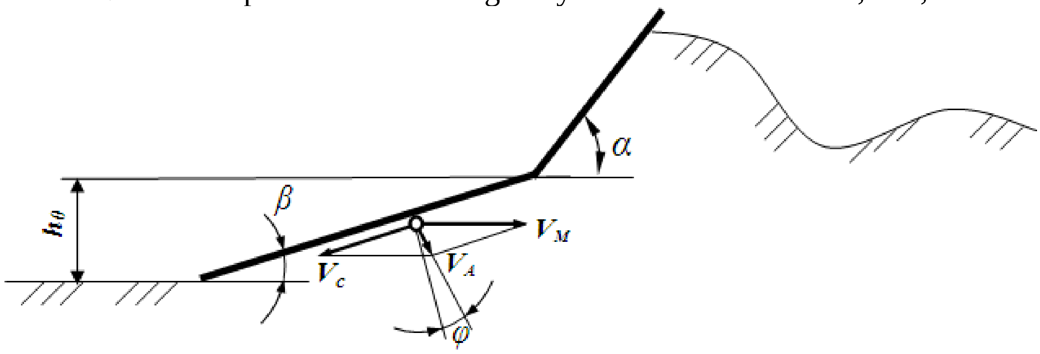


Figure 3. Scheme for determining the angle of installation of the compacting part of the working body relative to the horizon

We determine the depth of immersion of the compacting part of the working body into the soil according to the following expression [5]

$$h_o = h\left(1 - \frac{\rho_0}{\rho}\right), \qquad (7)$$

where h is the thickness of the soil compaction layer, i.e., the depth of soil softening (scraping or plowing) before the improved grinding wheel-leveler passes, m;

– the density of the treated layer of the soil before passing the improved grinder-leveler, g/cm3;

- the density of the soil after passing the improved grinder-leveler, g/cm3.

Taking into account the expression (7), the expression (6) will have the following form

$$t = \frac{h(\rho - \rho_0)}{\rho V_м(\cos\beta - f\sin\beta)\sin\beta}. \qquad (8)$$

Examining this expression to the extremum in terms of angle, we find that t has a minimum value when the following condition is fulfilled

$$\beta = \frac{\pi}{4} - \frac{\varphi}{2}. \qquad (9)$$

ISSN NO: 2770-0003
Date of Publication: 12-09-2022

If we put the given values of φ into this expression, it follows that the angle should be between 27º-30º in order for t to have a minimum value.

We determine the length of the working surface of the compacting part of the working body according to the scheme presented in Figure 4. According to him

$$L \geq \frac{h_0}{\sin\beta} \qquad (10)$$

or (7) given the expression

$$L \geq \frac{h(1-\frac{\rho_0}{\rho})}{\sin\beta}\ . \qquad (11)$$

*Taking h=20 cm, r0,=0.9 g/cm3, r=1.2 g/cm3 and putting the above value of (11) into the expression, we determine that the length of the working surface of the compacting part of the working body should be at least 11 cm.*

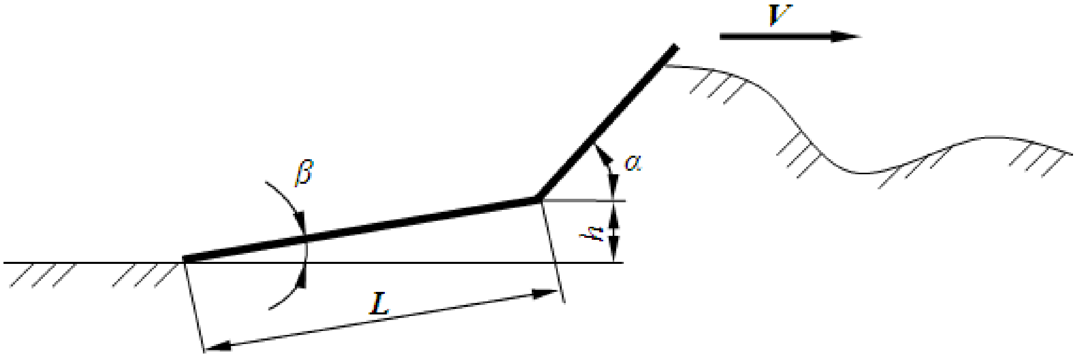


**Figure 4. Scheme for determining the length of the working surface of the working body**

The height of the working body. We determine this parameter according to the following expression derived from the condition that the soil compacted in front of the working body does not exceed it

$$H_T \geq \sqrt{\frac{4Z_н l_н}{\pi\left[ctg\mu - ctg(\alpha\ +\beta)\right]}} + h(1-\frac{\rho_o}{\rho}), \qquad (12)$$

where Zn, ln is the height and length of unevenness on the surface of the field, m;

□-slope angle of the piled soil in front of the leveler (in the direction of movement), grad.Zn=5 cm; h=20 cm; □0 =0.9 g/cm3; □=1.2 g/cm3; ln=45 cm; =30º; Taking □=60º and □=30º, the calculations based on expression (12) showed that the height of the working body should be at least 19.1 cm.

We determine the vertical load we give to the working body based on the condition of ensuring that the soil is compacted under its influence to the required level (Fig. 5). In this case, we can assume that the vertical component of the relative pressure of the compacting part of the working body on the working surface of the soil is directly proportional to its deformation [6], i.e.

$$\sigma_T = q_0 \Delta h, \qquad (13)$$

where q0 is the volume compression coefficient of the soil;

-deformation (crushing) of the soil in the vertical direction under the influence of the compacting part of the working body.

Taking into account the expression (13), we get the following from the scheme presented in Fig. 5

$$Q = q_0 B \frac{h_0^2}{2\sin\beta}\ , \qquad (14)$$

ISSN NO: 2770-0003
Date of Publication: 12-09-2022

where V is the width of the working body (grinding leveler), m.

It is known from the literature [7] that the volume crushing coefficient of the soil depends on its deformation (crushing) rate, i.e.

$$q_0 = q_0'(1+\kappa_V V_Э), \qquad (15)$$

where - volumetric compression coefficient obtained in static tests of the soil, i.e. at speeds close to zero deformation rate;

- the coefficient that takes into account the change of the volume crushing coefficient of the soil depending on its crushing speed;

– velocity of soil compaction in vertical direction, m/s.

The speed of crushing by the soil compactor according to the scheme presented in Fig. 3

$$V_Э = V_c \cos(90-\beta) = V_M(\cos\beta - \sin\beta\ tg\varphi)\sin\beta\,. \qquad (16)$$

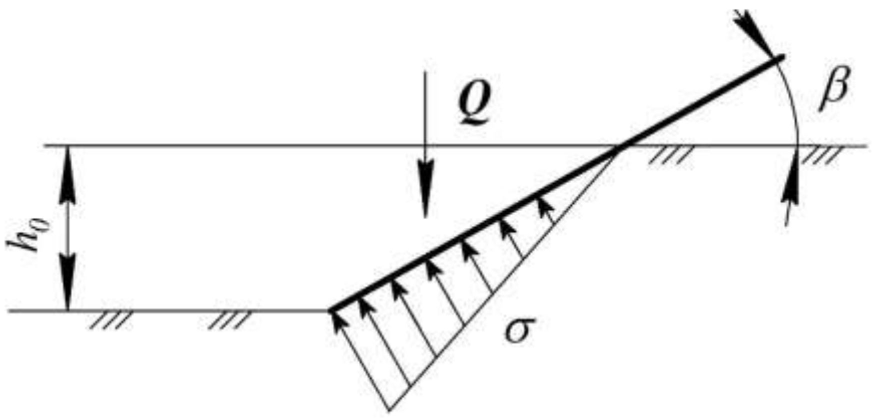


**Figure 5. The scheme for determining the vertical load given to the work body**

**Taking into account the expressions (15) and (16), the expression (14) has the following form**

$$Q = q_0'\left[1+\kappa_V V_M(\cos\beta - \sin\beta\, tg\varphi)\sin\beta\right]Bh_0^2 \qquad (17)$$

or (7) given the expression

$$Q = q_0'\left[1+\kappa_V V_M(\cos\beta - \sin\beta\, tg\varphi)\sin\beta\ \right]Bh^2(1-\frac{\rho_0}{\rho})^2. \qquad (18)$$

Divide both sides of this expression by the width of the working body and determine the specific vertical load per unit of its width

$$Q^c = q_0'\left[1+\kappa_V V_M(\cos\beta - \sin\beta\ tg\varphi)\sin\beta\ \right]h_0^{\ 2}(1-\frac{\rho_0}{\rho})^2 \qquad (19)$$

As it can be seen from the analysis of this expression, the vertical loading applied to the working body depends on the physical and mechanical properties of the soil ( , , ), its degree of compaction, aggregate movement speed ( ), processing depth (h) and the angle of installation of the compacting part of the working body relative to the horizon.

$q_0' = 1\cdot10^6$ Н/м$^3$, $\kappa_V = 0{,}1$ с/м, $\beta = 30^o$, $\varphi$=30°, $h$=0,20 м, $\rho_o$=0,9 г/м$^3$ ва $\rho$=1,2 г/м$^3$ қабул қилиниб, According to the calculations made according to the expression (19), the vertical load applied to the working body at speeds of 6-8 km/h should be 2.62-2.65 kN/m to ensure soil compaction at the required level.

Conclusions: In order for the improved grinder-leveler to ensure the required quality of work with low energy consumption, the angles of installation of the leveling and compacting parts of the working body relative to the horizon are at least 60° and 27-30°, respectively, the length of the working surface of the compacting part is at least 11 cm, the length of the working body the height should be at least 19.1 cm and the vertical load applied to it should be in the range of 2.62-2.65 kN/m.

ISSN NO: 2770-0003
Date of Publication: 12-09-2022

**References Used**

1. Sokolov F.A. Basic mechanization of agronomy Khlopkovodstva. - Tashkent: Science, 1977.-224p.
2. Model technology cards for care of agricultural crops and production. For 2011-2015 (Part). UzRQSXV - Tashkent: "HILOL MEDIA", 2011.-43p.
3. Adjustment and efficiency of cotton and grain machines to use - Tashkent: Science, 2012. - 192 p.
4. Sergienko V.A. Технологические основы хопанизации обработки почвы в междурядях хлопчатника. - Tashkent: Science, 1978-112b.
5. Utepbergenov B.K. Obosnovanie parametrov vyravnivayushchego rabochego organa ryxlitelya-vyravnivatelya: Dis ... kand.tex.nauk -Yangiyul, 2001-147 p.
6. Klenin N.I., Sakun V.A. Selskohozyaystvennye and meliorativnye car. - Moscow: Kolos, 2005-671 p.
7. Sineokov G.N., Panov I.M. Teoriya i raschet pochvoobrabatyvayushchikh car. - Moscow: Mashinostroenie. 1977-328 p.