ISSN: 2350-0328

International Journal of AdvancedResearch in Science, Engineering and Technology

Vol. 7, Issue 7 , July 2020

Justification of Parameters of the Loosening Working Body

TovashovR.Kh.,MakhamovKh.T., Tovashov B.R.

Basic doctoral student, Karshi Engineering-Economics Institute (KIEI), Karshi, Uzbekistan
Docent, Karshi State University (KSU),Karshi, Uzbekistan
Master student, Karshi Engineering-Economics Institute (KIEI), Karshi, Uzbekistan

ABSTRACT:A loosening with differently sized upper and lower working bodies of the "chisel" type carries out soilless erosion-free tillage. The purpose of the study is to justify the parameters of the loosening working body. Two- and three-sided piles were used to substantiate the loosening parameters, and the processes of soil deformation and disintegration under their influence were considered.The main parameters of the loosening working body are its crumbling angle, solution angle and working width. Analytical dependences for determining the crumbling angle, solution angle and working width of the loosening working body are obtained.The softening of the soil with the parameters α=28-32^0, $2\gamma_к$= 50-60^0, $2\gamma_u$=60-70^0, b_u=8,75 cm, b_u=23,3 cm, respectively, ensures that the soil is compacted at the required level.

KEY WORDS: Loosening, Chisel, Crumbling Angle, Solution Angle, Working Width, Stability, Tillage

I.INTRODUCTION

The analysis shows the need to develop technologies and special tools for soilless tillage in Uzbekistan [1].

Researchers have developed loosenings that have different sized working bodies of the Chisel type. When treating slopes with this type of loosening, ridges are formed at the bottom and topsoil at the top of the softened layer, which contributes to water retention and accumulation in the soil, resulting in water erosion prevention [2, 3].

II. SIGNIFICANCE OF THE SYSTEM

The article presents the results of studies to substantiate the parameters of the loosening working body. The study of literature survey is presented in section III, methodology is explained in section IV, section V covers the experimental results of the study, and section VI discusses the future study and conclusion.

III. LITERATURE SURVEY

In the experimental studies, the chisel loosening should be installed in the longitudinal and transverse planes at an angle of 67 and 40-45^0, respectively, and the angle of penetration of the screed into the soil should be in the range of 16-21^0, in order to cultivate the soil at the required level with minimal energy consumption. need [4]. In chisel cultivators, the width between the tracks of the working bodies should not exceed 200 mm to ensure the required level of soil compaction [5]. In order to ensure quality tillage with minimal energy consumption at high operating speeds, the working surface of the chisel-cultivator softener claw should be made in the form of a three-sided wedge and have the following parameters: width b=50-55 mm; sharpening angle of the sharpened part $2\gamma=60^o$; chest opening angle $\beta=120^o$; the angle of entry into the soil is $\alpha=34\text{-}39^0$ [6].

IV. METHODOLOGY

In the studies applied methods of theoretical mechanics and agricultural mechanics. Two- and three-sided piles were used to substantiate the loosening parameters, and the processes of soil deformation and disintegration under their influence were considered [2, 3]. The main criterion for substantiating the optimal values of the loosening parameters is

ISSN: 2350-0328

International Journal of AdvancedResearch in Science, Engineering and Technology

Vol. 7, Issue 7 , July 2020

the quality of soil compaction, the absence of a dense layer at the bottom of the loosening layer. The main parameters of the loosening working body are its crumbling angle, solution angle and working width.

We consider the processes of deformation and disintegration of the soil under the influence of a two-sided pile: when the pile passes from state I to state II (Fig. 1), the soil is first compressed by its working surface and the soil moves when the stresses reach a critical value ψ is decomposed along the plane ABB_1A_1 at an angle to the plane. The processes highlighted in the subsequent migration of the pona are repeated in series S step, i.e. the soil is first compacted and then prismatic lumps are separated from it. This decomposition step S of the soil makes it possible to determine them depending on certain parameters. The reason is that the smaller the disintegration step of the soil, the higher its crushing quality, and the lower the gravitational resistance of the working body.

V. EXPERIMENTAL RESULTS

Given that the soil under the influence of the working body is decomposed due to displacement, the following expression was obtained to determine the distance S [3]:

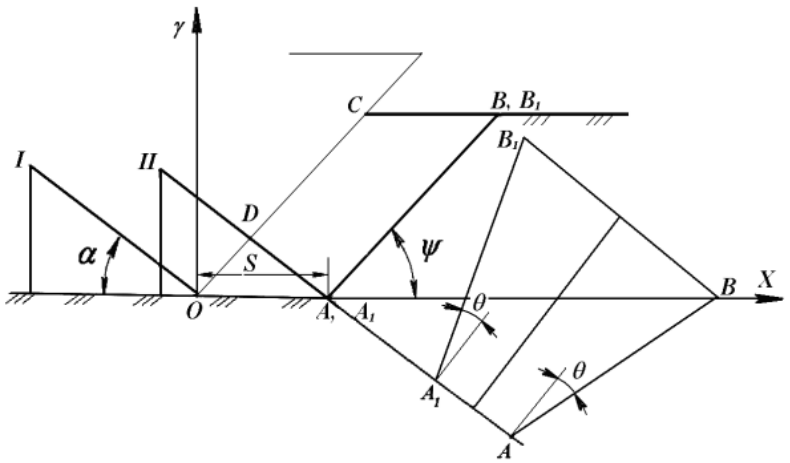


Figure 1. Deformation and decomposition processes under the influence of the working body of the soil

$$S = 2\sqrt{\frac{\left[\tau_к\right]\left[b_u \cos\frac{1}{2}(\alpha+\varphi_1+\varphi_2)+htg\left(\frac{\pi}{4}-\frac{\varphi_2}{2}\right)\right]h\cos\frac{1}{2}(\varphi_1+\varphi_2-\alpha)\cos\varphi_1}{q_0(1+K_vV)b\cos^2\frac{1}{2}(\alpha+\varphi_1+\varphi_2)\left[\cos(\alpha+\varphi_1)+\cos\varphi_2\right]\sin\alpha}}, \quad (1)$$

where $[\tau_k]$ is the shear resistance of the soil, Pa;

b_u- loosening width, m;

α - angle of penetration of the loosening into the soil, degree;

φ_1, φ_2- angles of external and internal friction of the soil, degree;

q_0 - coefficient of volumetric compaction of soil, N / m^3;

K_V -coefficient taking into account the variation of the volumetric crushing coefficient of the soil depending on the speed, s / m;

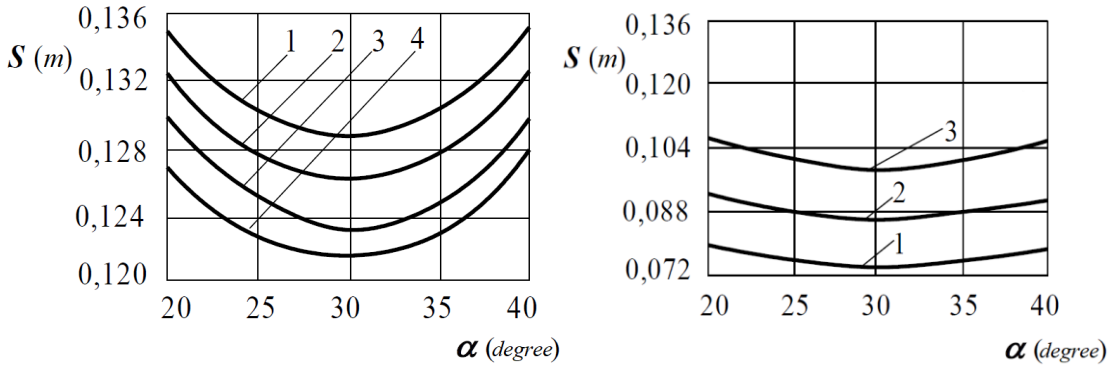
V- speed of movement, m / s;

h is the depth of immersion of the loosening in the soil, m.

(1) It can be seen from the expression that the value of S for a given working condition, depth and speed of processing depends mainly on the angle of entry of the working body into the soil. $[\tau_k]=2\cdot10^4$ Pa; $\varphi_1=30^o$; $\varphi_2=40^o$; $q_0=10^7$ N/m^3 and

ISSN: 2350-0328
International Journal of AdvancedResearch in Science, Engineering and Technology
Vol. 7, Issue 7 , July 2020

K_V=0,1 s/m; assumed in Fig. 2 (1) the graphs of the change of distance *S* depending on the angle α at different values of velocity and machining depth according to the expression. It can be seen from these graphs that in both cases the distance *S* varies in the form of a sunken parabola depending on the angle α, and when α=28-32^0 it has a minimum value.



1-*V*=1,5 m/s; 2- *V* =2,0 m/s; 3- *V* =2,5 m/s; 4- *V* =3,0 m/s;

1- *h*=20 cm; 2- *h* =25 cm; 3- *h* =30 cm;

ab

Figure 2. At different values of the working speed (a) and the depth of tillage (b), the distance traveled by the working body from the compaction of the soil to disintegration is given by the change graphs S depending on the angle of entry a to it.

Therefore, based on the above, it can be said that in order to decompose the soil with high quality and low energy consumption, the angle of access of the working body to it should be in the range of 28-32º.

We determine the angle of the loosening and the opening of the wings from the following expression [7]:

$$2\gamma = \frac{\pi}{2} - \varphi_б \quad (2)$$

where $\varphi_б$ is the angle of friction between the weeds and their roots on the axillary claw blades, degree.

Substituting certain values of $\varphi_б$ ($\varphi_б$ = 30-40º) [8] into expression (2), we determine that the opening angle of the loosening wings should be in the range of 50-60º.

The opening angle $2\gamma_{ю}$ of the loosening blade, the sharpening angle of the loosening blade and the wings $i_{ю}$ and $i_к$ and their thickness (blade) are taken as $\delta_{ю}$ and $\delta_к$ [7] as follows: $2\gamma_{ю}$ =60-70º, $i_{ю}$= $i_к$=15-20º, $\delta_{ю}$= $\delta_к$=0,3 cm.

The width of the loosening is determined by the following expression, provided that under the influence of it at the bottom of the treated layer does not form a compacted edge of the walls [3]:

$$b_u \geq \frac{h(n+ctg\alpha)}{0{,}1\frac{[\sigma_э]}{[\tau_k]}(1+tg\xi)-n} \quad (3)$$

where $[\sigma_э]$ is the specific resistance to soil compaction, Pa;

ξ is the angle of inclination of the force acting on the ground relative to the horizon, degree;

n, m are coefficients without units of measurement depending on the physical and mechanical properties of the soil.

ISSN: 2350-0328

International Journal of AdvancedResearch in Science, Engineering and Technology

Vol. 7, Issue 7 , July 2020

(3) shows that the width of the loosening depends primarily on the depth of tillage, the physical and mechanical properties of the soil and the angle of penetration of the working body into the soil. Assuming that m=4,2; $[\sigma_э]$=1,44·10^6 Pa and $[\tau_k]$=2·10^4 Pa, n = 2.5, (3) the width of the loosening is not less than 8,75 cm was found.

We determine the coverage width of the loosening wings by the following expression [9]:

$$b_к = b_u + \frac{2a_k \cdot tg\frac{\theta}{2}}{\cos(\frac{\pi}{2} - \psi)} \qquad (4)$$

Substituting certain values of Θ, ψ ($\Theta \approx 500$, $\psi \approx 400$) [9] into the expression (4), we determine that the coverage width of the loosening wings should not exceed 23.3 cm.

VI.CONCLUSION AND FUTURE WORK

Analytical dependences for determining the parameters of the loosening working body have been obtained. The softening of the soil with the parameters α=28-32^0, $2\gamma_к$= 50-60^0, $2\gamma_u$=60-70^0, b_u=8,75 cm, b_u=23,3 cm, respectively, ensures that the soil is compacted at the required level.

REFERENCES

[1]. Mamatov F.M., Mirzaev B.S., Mardonov Sh.Kh., Avazov I.Zh. Mechano - technological basis of tools for subsurface anti-erosion tillage: Voris-nashriyoti - Tashkent, 2015. – 11 p.
[2].Imomkulov K.B. Creating less power-consuming machines for soil tillage: Abstract of doc. diss. – Tashkent, 2016. – 13 p.
[3]. Mamadaliev M.H. Substantiation parameters friablings of the unit for the minimal processing of ground: Abs. of doc. of phil. in enj. diss. – Tashkent.2010. – 6 p.
[4]. Tryapitsyn D.A. Justification of the parameters of the chisel working body with an upright tilted in the transverse vertical plane // Research and development of tillage and sowing machines: collection of scientific papers. - Moscow, 1988. - 61–70 p.
[5]. Blackstein R. “Welchenschwergrubbersoll man emptehlen”. “Landmaschinen - Fachbetrieb”, 1976. – № 7.
[6]. Mirakhmatov M. Substantiation of the parameters of the chisel cultivator cultivating paw for working at higher speeds in the cotton growing zone: Diss. ... cand. tech. sciences. - Yangiyul: 1984. - 150 p.
[7]. Sineokov G.N., Panov I.M. Theory and calculation of tillage machines. - Moscow: Engineering, 1977. - 328 p.
[8].Utemuratova D.T. Justification of the parameters of a flat-cutting paw – razor of a cotton cultivator (on the example of the Republic of Karakalpakstan): Diss. ... cand. tech. sciences. - Yangiyul, 1994. - 126 p.
[9].Blednyh V.V. The device, calculation and design of tillage tools. - Chelyabinsk, 2010. - 100 p.