DETERMINATION OF THE DIAMETER OF THE CYLINDER PIECE OF CONCENTRATORY COATING WHILE MAKING A LONG LEVEL BETWEEN COTTON ROWS

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INTRODUCTION

Irrigated lands in the cotton-growing areas of the country are divided into three zones according to natural-climatic and soil conditions, mechanical composition of the soil, technology of its cultivation, types of machines and agro-technical requirements[1,2].

In Bukhara, Navoi, Khorezm, the regions of the third climatic zone, and in the Republic of Karakalpakstan, longitudinal and transverse floors are taken before the first irrigation of cotton, depending on the relief of the fields. Also, in soil climatic conditions of this area it is not possible to carry out the first irrigation without removing the floor[3,4].

It is known that the formation of a longitudinal floor between the rows of cotton is very important for watering cotton seedlings, saving the amount of water used for irrigation and uniform growth and development of cotton seedlings[5]. The height of the floor to be formed must be flat and above the water line[6]. At the same time, its density and profile are required to be at the required level, which prevents water from leaking from one contour to another during irrigation and makes it easier for the waterman to control the cuttings [7, 8].

A study of the work of various authors[9,10,11] devoted to soil compaction processes shows that the process of compaction of the formed floor is influenced by the interaction of soil and cathode, cathode pressure to soil, soil compression resistance, stress distribution in soil, partial recovery of deformed volume and cathode sliding. In view of the above, it is necessary to substantiate the parameters of the main working parts of the floor compaction cathode [12].

METHODS

The construction of the compacting roller consists of left and right conical parts and a middle cylindrical part, which compacts the sides and top of the floor formed by the device at the required level[13]. To ensure that the floor shape is at the required level under the influence of the roller, its working parts must compact the floor to the required level, crushing large lumps located on the soil surface. In this case, the soil should not spill from the top and sides of the floor[14].

Therefore, we study the process of interaction of the block above the floor with the cylindrical part of the compacting roller.

Forces R_1 and R_2 are formed as a result of the interaction between the flange of the cylindrical part and the soil lumps and between the soil lumps and the top of the ridge (Fig.

1). We divide these forces into the normal constituents $F_{н1}$and $F_{н2}$ and the friction forces F_{T1} and F_{T2}

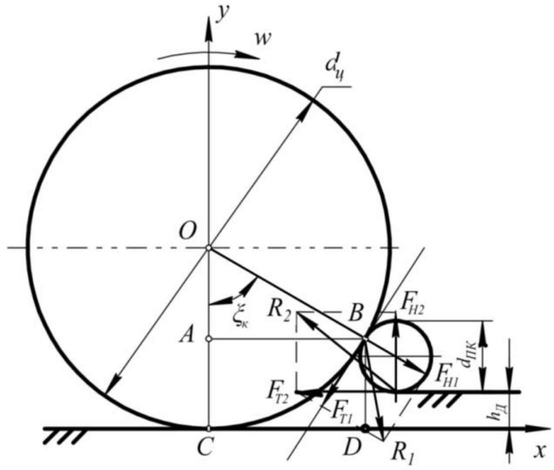

Figure 1. Interaction of the cylindrical part of the compacting cathode with the soil lumps

If the total value of the projections of the frictional forces on the x-axis is greater than the total amount of the projections of the repulsive forces on that axis, then the soil lumps are crushed under its influence as a result of compression between the cylindrical part of the roller and the upper part of the floor. However, if this condition is not met, then the soil lumps will be pushed forward, causing the soil lumps to form in front of the compaction roller and spill them to the sides. As a result, the technological process is disrupted[15].

In view of the above, we examine the compression of the blocks between the cylindrical part of the compacting roller and the upper part of the floor[16]. In order to simplify the calculations, the compacted roller moves along the floor surface without slipping and cracking, the soil surface is not deformed at the location of the blocks, the blocks have a spherical shape and its diameter is assumed to be dPKmax.

RESULTS

Excluding the weight of the block, we determine the condition of its compression by the equation of the projection of all forces on the x and y axes, namel[17]

$$\sum F_{kx} = F_{H1}\sin\xi_{к} - F_{T1}\cos\xi_{к} - F_{T2} = 0 \quad (1)$$

and

$$\sum F_{ky} = F_{H2} - F_{H1}\cos\xi_{к} - F_{T1}\sin\xi_{к} = 0, \quad (2)$$

where $\xi_{к}$ –is the compression angle of the block, grad.

As you know [18]

$$F_{T1} = \mu_1 F_{H1} \quad (3)$$

and

$$F_{T2} = \mu_2 F_{H2}, \quad (4)$$

where μ_1, μ_2 are the coefficients of friction of the compacted cathode with the lumps and the lumps of the soil, respectively.

Expressions (1) and (2), taking into account expressions (3) and (4), can be written as follows:

$$\sum F_{kx} = F_{H1}\sin\xi_{\kappa} - \mu_1 F_{H1}\cos\xi_{\kappa} - \mu_2 F_{H2} = 0 \qquad (5)$$

and

$$\sum F_{ky} = F_{H2} - F_{H1}\cos\xi_{\kappa} - \mu_1 F_{H1}\sin\xi_{\kappa} = 0. \qquad (6)$$

From expression (6) we determine the normal force FN2 resulting from the interaction of the blocks with the soil surface and put it in expression (5):

$$\sum F_{kx} = F_{H1}\sin\xi_{\kappa} - \mu_1 F_{H1}\cos\xi_{\kappa} - \mu_2 F_{H1}\cos\xi_{\kappa} - \mu_1\mu_2 F_{H1}\sin\xi_{\kappa} = 0. \qquad (7)$$

From this expression we obtain the following expression after the corresponding mathematical modifications:

$$(1-\mu_1\mu_2)\sin\xi_{\kappa} = (\mu_1+\mu_2)\cos\xi_{\kappa}. \qquad (8)$$

Both sides of this expression are divided into cosxk and can be written as follows:

$$tg\xi_{\kappa} = (\mu_1+\mu_2)/(1-\mu_1\mu_2). \qquad (9)$$

The following condition must be met to ensure the compression of the blocks by the compactor:

$$tg\xi_{\kappa} \geq (\mu_1+\mu_2)/(1-\mu_1\mu_2) \qquad (10)$$

or

$$\xi_{\kappa} \geq arctg[(\mu_1+\mu_2)/(1-\mu_1\mu_2)]. \qquad (11)$$

From the diagram shown in Figure 1, we obtain the following

$$BD = h_{Д} + 0{,}5d_{ПК\max} + 0{,}5d_{ПК\max}\cos\xi_{\kappa} \qquad (12)$$

or

$$BD = h_{Д} + 0{,}5d_{ПК\max}[1+\cos\xi_{\kappa}]. \qquad (13)$$

where $h_{Д}$ is the amount of deformation under the action of the compacted cathode of the floor (soil), m

We write the following expression for the distance AS

$$AC = BD = 0{,}5D_{ц} - 0{,}5D_{ц}\cos\xi_{\kappa} = 0{,}5D_{ц}[1-\cos\xi_{\kappa}]. \qquad (14)$$

Since AC = BD, in addition, taking into account expression (11), the diameter of the cylindrical part of the condensing cathode is determined as follows:

$$D_{ц} \geq \frac{2\{h_{Д} + 0{,}5d_{ПК\max}\langle 1+\cos\{arctg[(\mu_1+\mu_2)/(1-\mu_1\mu_2)]\}\rangle\}}{1-\cos\{arctg[(\mu_1+\mu_2)/(1-\mu_1\mu_2)]\}}. \qquad (15)$$

Discussion.

Thus, formula (15) shows that the diameter of the cylindrical part of the compacted cathode depends on the height of the deformed soil layer, the maximum diameter of the cores, the coefficient of friction between the compacted cathode and the soil block, the coefficient of friction between the soil and the block.

It is known from the literature [19] The amount of deformation of the resulting floor under the action of a compact cathode:

$$h_Д = h_п\left(1-\frac{\rho_0}{\rho}\right), \qquad (16)$$

where ρ_0 is the initial density of the floor soil, г/см^3;

ρ is the required density of the floor soil, г/см^3

Given (16), expression (15) has the following form

$$D_ц \geq \frac{2\left\{h_п\left(1-\frac{\rho_0}{\rho}\right)+0{,}5d_{ПК\max}\langle 1+\cos\{arctg[(\mu_1+\mu_2)/(1-\mu_1\mu_2)]\}\rangle\right\}}{1-\cos\{arctg[(\mu_1+\mu_2)/(1-\mu_1\mu_2)]\}}.$$

(17)

Using the scheme shown in Figure 1, we determine the diameter of the conical part of the compacting cathode according to the following expression

$$D_к = D_ц + 2B_к tg\alpha. \qquad (18)$$

This expression has the following form, taking into account the angle of inclination of the conical part of the compact cathode and the width of the conical part of the compact cathode:

$$D_к \geq \frac{2\left\{h_п\left(1-\frac{\rho_0}{\rho}\right)+0{,}5d_{ПК\max}\langle 1+\cos\{arctg[(\mu_1+\mu_2)/(1-\mu_1\mu_2)]\}\rangle\right\}}{1-\cos\{arctg[(\mu_1+\mu_2)/(1-\mu_1\mu_2)]\}}+$$

$$+(B_м - 2B_х - 2S_T - 2\Delta - B_ц)tg\varphi_и. \qquad (19)$$

CONCLUSION

At the following parameters of the cathode: $\varphi_и$*=38^0, $h_п$=25 см, $B_м$= 60 см*[20], *$B_х$=10 см, S_T=1 см, Δ=0,3 см, $B_ц$=20 см,* when the indicators of physical and mechanical properties of the soil have the following values : *ρ_0= 1,05 г/см^3, ρ= 1,25 г/см^3, μ_1 =0,6, μ_2 = 1,0* (17), (19) expressions the slope angle of the conical part of the compaction cathode shall not exceed 38^0, the total length of the coil shall be 37.4 cm, the length of the conical part shall be 8.7 cm, the diameter of the cylindrical part shall be at least 17.05 cm, and the large diameter of the conical part shall be at least 30.62 cm showed that it is necessary.

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