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In Article predstavlenы results about A methodical descriptions matematycheskoy model provisions Provision of technical peryodychnosty of service machines lesotehnycheskyh works.

Assets, Tehnicheskoe Maintenance, peryodychnost machine.

Results of rather methodical provisions of description of mathematical model of ensuring frequency of maintenance of machinery for timber works are presented in paper.

Means, maintenance, frequency, mashine.

UDC 631.3 + 531.2

METHOD FOR DETERMINING PARAMETERS OF INERTIA OF CROP PLANTS

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In the article the method of determining the parameters of inertia of plant crops by sharing their linear density. The analytical and

experimental part of the process. The parameters of inertia of different types of rootstocks of fruit crops.

Weight, static moment, the moment of inertia, linear density.

Formulation of the problem. Some of the main parameters that must be considered in the development of mathematical models of processes related to planting or digging up plants crops (sugar beet, potato, tomato seedlings, rootstocks, seedlings, etc..) - It is their mass, static moment and moment of inertia . To simulate such objects are depending on the source of the physical, biological and other laws that describe their operation. In this case the movement of plants from the starting position in a given. To increase the accuracy of the modeling process moving in the space of plants with different shapes and probably heterogeneous structure by calculation of inertia parameters given linear density and the receipt of such dependencies is an urgent task.

Analysis of recent research. The current study, which describes the analytical methods for determining the parameters of inertia of simple and complex bodies can be used mainly in the analysis and design of machine parts and mechanisms [1, 2]. In determining the parameters of inertia of the crop plants can be used physical pendulum method [3]. Yes, [4] the time

Tomato seedlings inertia determined by fluctuations. For this determined weight of seedlings and the distance from the center of gravity to the root system of the plant. Then plant pidvishuvalasya root of the thread for a certain length, deviated from the vertical at a specific angle and vidpuskalasya. Thus defined oscillation period and calculated the required moment of inertia. In [5], the justification of operating parameters beet harvesting machine proposed theoretical method of determining the moment of inertia of root sugar beet on their own axes. It is necessary to take into account the weight and length of the conical ro-ot crops in the sample.

If the body is uniform, the theory accurately calculate its moment of inertia possible, presenting the body as limit the amount of products infinitely large number of infinitely small elements of mass dm by the square of their distance from the axis. [1] In this case, determining the moment of inertia reduced to the calculation of volume integral:

$$J = \int_m r^2 dm = \int_V \rho r^2 dV \,, \qquad (1)$$

where: $dm = \rho dV$ - The mass of small volume element of the body dv;

ρ - Density of the body;

r - Distance from the body element dv to the axis.

Just calculate the moment of inertia of the plant by the formula (1) difficult, because real bodies do not have the correct geometrical shape and homogeneous structure. In order to take into account the heterogeneity of the structure of plants, in determining its parameters inertia, it is appropriate to apply the change of its linear density, which shows the distribution of body weight along its length.

The purpose of research. Develop a method for determining the parameters of inertia of plant crops thrust information on the distribution of linear density.

Results. Pattern of linear density of plants of different shapes are shown in Fig. 1: A - conventional plants start point; B - conventional end point of the plant; O - the center of gravity plant; L - total length of the plant; LTST - distance to the center of gravity; x - the current point on the longitudinal axis of crossing plants; γ (x) - linear density of plants.

Then the mass, static moment and the moment of inertia of the body relative to AT plants can be determined by the formula [1]:

$$I_0 = \int_0^L \gamma(x)dx; \quad I_1 = \int_0^L \gamma(x)xdx; \quad I_2 = \int_0^L \gamma(x)x^2dx, \tag{2}$$

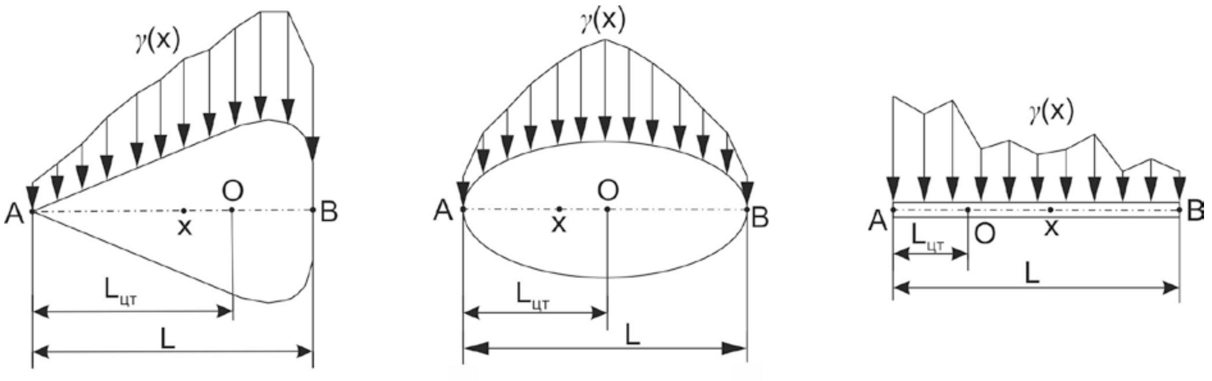
where: x - the current point on the longitudinal axis of crossing plants (Fig. 1);

I_0 - The mass of plants kg;

I_1 - Plants relatively static moment t. A m3;

I_2 - Moment of inertia plants relatively so. A kg · m2;

$\gamma = \gamma$(L) - linear density of plants kg / m.



and) b) in)

Fig. 1. Plans linear density of plants of different forms: a) conical (root sugar beet); b) ellipse (root potatoes); c) cylindrical (tomato seedlings, seedling rootstock or fruit crops).

In order to determine how the density of plants distributed along its length, in laboratory conditions necessary [6]

1) sample studied form of plants;
2) determine the total length L of each plant:

3) physically divide each plant at ni parts li equal length of 20-25 mm (Fig. 2);

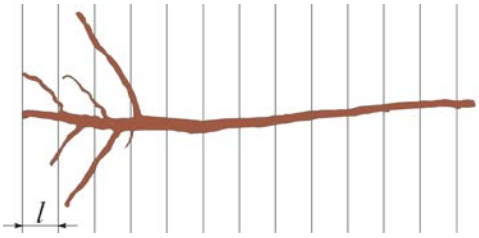


Fig. 2. Scheme of division on the stock: l - length separated part of the stock.

4) mi determine the mass of each separate part of the plant.

The parameters of separate parts of the plant can be presented as Table. 1.

The value of linear density for each of the separate parts is calculated by the formula:

$$\gamma_i = \frac{m_i}{l_i}, \tag{3}$$

where: γ_i - linear density separated parts of the plant, kg / m;

m_i - Mass separated parts of the plant, kg;

l_i - Length separated parts of the plant, m.

1. The parameters separated parts of the plant.

Part Number, n	The length l, m	The mass m, kg	Linear density γi, kg / m
1	*l1*	*m1*	*γ1*
2	*l2*	*m2*	*γ2*
...	...	...	...
n	*ln*	*mn*	*γn*

However, the linear density separated parts of the plant, calculated from the formula (2) does not reflect its changes depending on the entire length of the plant.

In order to determine the change in linear density along the length plants need to ask her value as a function $\gamma^{(i)}(x)$ Where x - the current point in the longitudinal axis of the plants (Fig. 1). This feature displays a linear density of j-th plants along the length of the segment from point A, the argument which is the ratio Ah / L.

Using the data table. 1 may set the function at the points: (l1 / 2) / L; (l1 + l2 / 2) L; (l1 + l2 + l3 / 2) / L, etc. so that the function $\gamma^{(i)}(x)$ can be considered of equal value (3) in the first, second and subsequent segments (separated parts).

Determine the function $\gamma^{(i)}(x)$ at intermediate points by using linear interpolation. [7]

According to this method, if f0, f1 - the function f (x) at the points x0, x1, then the function at other points will be determined by the formula:

$$f(x) = \frac{1}{x_1 - x_0}\begin{vmatrix} x - x_0 & f_0 \\ x - x_1 & f_1 \end{vmatrix}. \tag{4}$$

Using the formula (4), set function $\gamma^{(i)}(x)$ in the form of:

$$\gamma^{(i)}(x) = \begin{cases} \frac{2L}{l_1 + l_2}(\gamma_2(x - \frac{l_1}{2L}) - \gamma_1(x - \frac{l_2}{2L} - \frac{l_1}{L})), \\ якщо \quad x < \frac{l_2}{2L} + \frac{l_1}{L} \\ \frac{2L}{l_j + l_{j+1}}(\gamma_{j+1}(x - \frac{l_j}{2L} - \frac{1}{L}\sum_{k=1}^{j-1} l_k) - \gamma_j(x - \frac{l_{j+1}}{2L} - \frac{1}{L}\sum_{k=1}^{j} l_k)), \\ якщо \quad \frac{l_j}{2L} + \frac{1}{L}\sum_{k=1}^{j-1} l_k < x < \frac{l_{j+1}}{2L} + \frac{1}{L}\sum_{k=1}^{j} l_k \\ \frac{2L}{l_n + l_{n-1}}(\gamma_n(x - \frac{l_{n-1}}{2L} - \frac{1}{L}\sum_{k=1}^{n-2} l_k) - \gamma_{n-1}(x - \frac{l_n}{2L} - \frac{1}{L}\sum_{k=1}^{n-1} l_k)), \\ якщо \quad x > \frac{l_{n-1}}{2L} + \frac{1}{L}\sum_{k=1}^{n-2} l_k \end{cases} \tag{5}$$

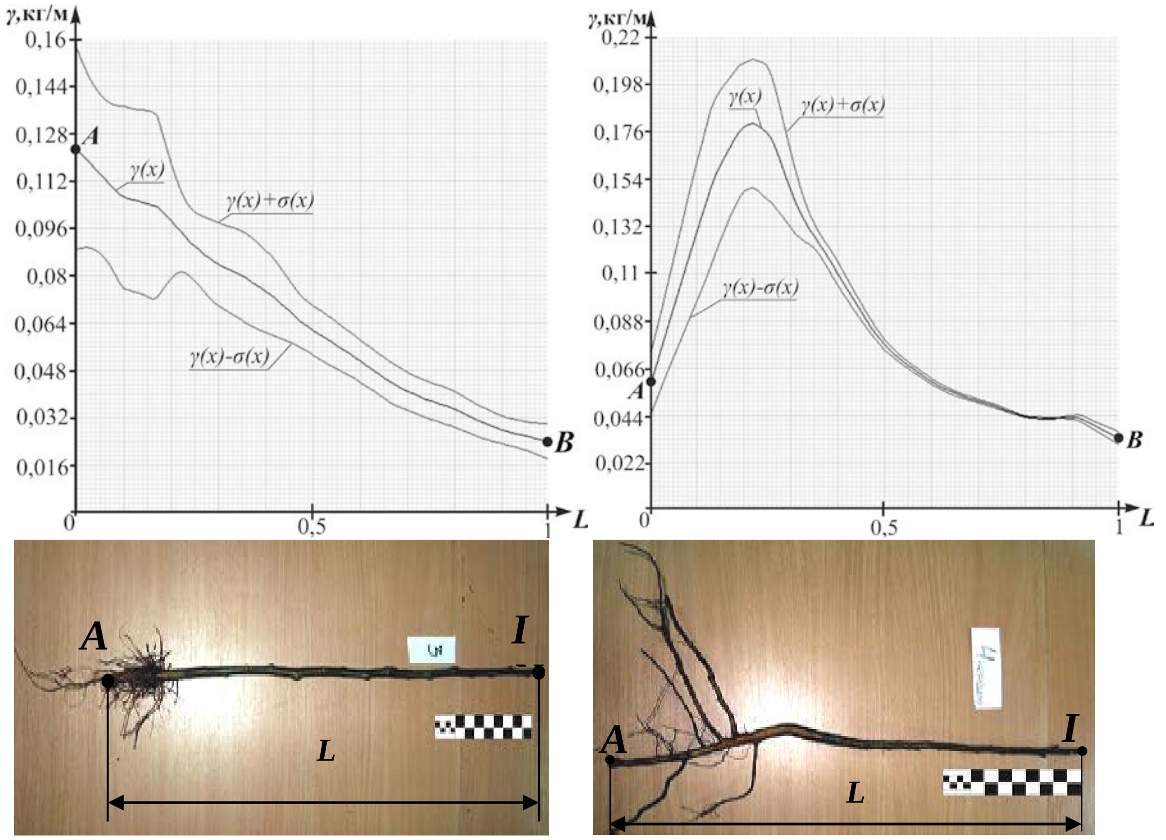
To determine the arithmetic mean linear density, which in this case would be deterministic component features $\gamma^{(i)}(x)$ the relative length of the plant, use the formula:

$$\gamma_{cp}(x) = \frac{1}{N}\sum_{i=1}^{N} \gamma^{(i)}(x). \tag{6}$$

Deviation from the mean (serednyekvadratychne deviation) for each function we assume stochastic component, calculated according to the formula:

$$\sigma(x) = \sqrt{\frac{1}{N-1}\sum_{i=1}^{N} (\gamma^{(i)}(x) - \gamma_{cp}(x))^2} \quad . \tag{7}$$

The proposed method was applied in determining the parameters of inertia rootstocks of fruit crops. To study were selected two types of rootstocks, pome - M9 apple and stone fruit - cherries. Were formed sample of 50 pieces of each type rootstocks such lengths ranges: for apple M9 - from 400 to 540 mm, cherries - from 450 to 550 mm. Determined length L of each of the stock in the sample, and the length li (Fig. 2) separated parts, and their masses mi. Using the formula (4) using the program environment Delphi 7 defined linear density distribution of pome and stone fruit rootstocks species, graphs are presented in Fig. 3.



and) b)

Fig. 3. Linear density rootstocks: a) M9 apple; b) cherries.

Analyzing the data dependence, we can conclude that the distribution of linear density depends on the type of rootstock. For pome rootstocks (Fig. 3, a) density gradually decreases from the base of the root (TA - 0.122 kg / m) to the top of the stock (t.V - 0,022 kg / m). For stone fruit rootstocks other distribution (Fig. 3, B). The density increases from the root of the (AT - 0.06 kg / m) to the center of gravity, which gets the highest value - 0,18 kg / m, and further reduced to the top of the stock (t.V - 0.03 kg / m).

More on formulas (1) calculated mass, static moment and the moment of inertia about the root of rootstocks, the limit values are given in the Table. 2.

2. Parameters inertia rootstocks of fruit crops.

Type rootstocks	Weight, kg		Static point m3		Moment of inertia kg · m2	
	min	max	min	max	min	max
Apple M9	23 · 10-3	43 · 10-3	4 · 10-3	8 · 10-3	6 · 10-4	16 · 10-4
Merry	36 · 10-3	59 · 10-3	12 · 10-3	21 · 10-3	3 · 10-3	71 · 10-4

The data used to develop a mathematical model of the process of planting rootstocks of fruit crops disk type apparatus. [8] The model was the probabilistic nature of the calculation of which was the required information about the variable mass, static moment and moment of inertia rootstocks.

Conclusion. The proposed method of determining the parameters of inertia of plant crops through the distribution of linear density can be used in the development of mathematical models of processes associated with the movement in the space of plant various crops at planting or digging them.

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In this article Method for determining parameters for proposals inertia selskohozyaystvennыh crop plants at the expense of apportionment s linear density. Present analytycheskaya and experimental part ways. Opredelenы Options inertia DIFFERENT species podvoev plodovыh cultures.

Massa, statycheskyy moment, moment of inertia, Linear density.

The method for defining the plants inertia parameters of crops plants at the expense of their linear density distribution has been pro-

posed. The analytical and experimental parts of mode have been given. The inertia parameters of various fruit crops stock types have been defined.

Mass, static moment, inertia moment, linear density.