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KINEMATIC ANALYSIS OF THE MOVEMENT OF THE ACTIVE KNIFE CUTTER OF CHICORY ROOTS

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Summary. Chicory roots are a valuable technical and strategically important crop for the leading sectors of the Ukrainian economy. The processing of raw materials from chicory roots allows to obtain energy (biofuel), food (coffee) and pharmaceutical (inulin) products. The low level of mechanization of harvesting root crops and, especially, harvesting both chicory and chicory root crops (significant losses, damage) does not allow to provide the needs of raw materials for its processing, or the necessary provision of the food industry of the Ukrainian economy and the fodder base of animal husbandry due to an increase in the amount of use root crops of chicory. One of the reserves for improving the performance of machines for harvesting chicory root crops is the improvement of the technological process of harvesting ginseng through the use of improved main working organs – a rotary ginseng cutter and a cutter of ginseng residues from the heads of root crops. The purpose of the work is to increase the indicators of the technological process of harvesting chicory root crops by developing and substantiating the parameters of the cutter's working organs. On the basis of the conducted theoretical analysis of the process of movement of the active cutter knife along the head of the root crop, analytical dependencies were developed that functionally describe the process of movement of the active cutter knife along the root crop head, which made it possible to substantiate the main structural and kinematic parameters of the active cutter knife. It has been established that the working length of the active knife of the cutter of the remains of burdock from the heads of root crops is in the range from 0.25 to 0.3 m, provided that the maximum permissible deviation of the vertical axis of the root crop from the axis of the row at the speed of movement of the burdock harvesting module is from 1.6 to 2.2 m/s and the speed of movement of the cutting edge of the blade of the active knife in the range from 0.3 to 0.8 m/s.

Key words: root crops, root head; process; copier; cutting; model; parameters.

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Statement of the problem. The necessary provision of the food industry of the economy of Ukraine and the fodder base of animal husbandry due to the increase in the consumption of food products from the processing of raw materials of chicory root crops and rhizomes of root crops is largely restrained by the low level of mechanization of their production and, especially, harvesting, both rhizomes and root crops. Depending on the operating conditions of the root harvesters, total losses and damage to chicory root crops amount to more than 5...10% [1–3].

Significant losses and damage to chicory root crops are explained by the use of imperfect working organs for cutting the main mass of the gorse and trimming its remains from the root heads, which at the same time do not provide adequate indicators of the quality of cutting the heads and fall out of the soil a significant amount of root crops (up to 35%) due to significant dynamic loads that arise in the process of contact of both the copier and the knife with the head [4–6].

One of the reserves for improving the performance of machines for harvesting chicory root crops is the improvement of the technological process of harvesting root crops by using the main improved working organs of chicory harvesting modules – a rotary chicory cutter and a trimmer of chicory residues from root heads [7, 8].

The purpose of the work is to improve the indicators of the technological process of harvesting chicory root pulp by developing and substantiating the parameters of the active knife of the cutter of pulp residues from root crops.

In this regard, the development of improved technological processes and working bodies for collecting chicory root pulp and the study of the influence of their structural and kinematic parameters in order to improve the quality indicators of the pulp harvesting modules is an urgent scientific task.

Materials and methods. Different types of cutters with different configurations of placement of working organs are used to cut off the remains of the roots from the heads of root crops [9, 10]. Depending on the agrobiological and physical-mechanical characteristics of root crops and the operating conditions of root-harvesting machines, root crop head cutters, which are made according to the «passive copier-passive knife» and «passive copier-active knife» schemes, have found the predominant use in modern goch harvesting modules [11–14].

At the same time, the passive knife cuts the heads of root crops using the method of cutting by «slicing» the body of the root crop, and the active knife uses the method of cutting by «sliding». Considering the significant fragility of chicory root crops, for example, relative to sugar and fodder beet root crops [15–17], the most appropriate scheme for trimming the heads of chicory root crops can be considered a cutter made according to the «passive copier-active knife» scheme.

The active knife 4 (Fig. 1) can be made spring-loaded with the possibility of deflection to a given angle at the moment of contact with the head of the root crop due to the installed spring 8 [18], or have the ability to carry out transverse plane-parallel (reciprocating) movement of the cutting edge 7 relative to the axial line of the row of root crops [19].

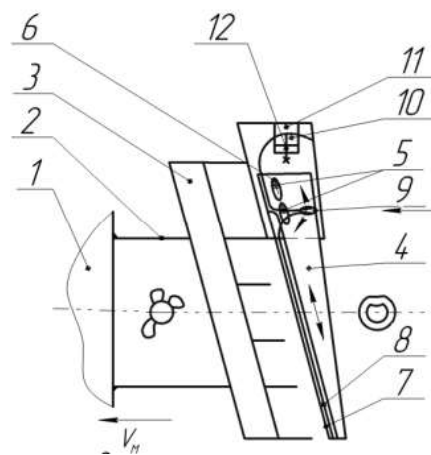


Figure 1. Scheme of a root crop cutter: 1 – frame; 2 – parallelogram suspension; 3 – comb copier; 4 – a knife; 5 – fixed axis; 6 – longitudinal groove; 7 – cutting edge of the knife; 8 – the longer side of the spring; 9 – knife groove; 10 – groove of the retainer; 11 – retainer; 12 – screw

The use of such a design of the knife allows to significantly reduce dynamic loads on the root crop at the moment of contact of the cutting edge of the knife with the head of the root crop and subsequent cutting of the remains of the root from it [20]. Therefore, the purpose of the article is to justify the main parameters of the active cutter knife by developing analytical dependencies that describe the process of moving the knife along the head of the root crop while cutting off the remains of burdock from the heads of root crops.

Highlighting previously unresolved parts of the overall problem. The movement of the active knife of the pruner along the head of root crops in the process of cutting the remains of the root crop requires conducting research aimed at establishing the relationship between the

working speed of the movement of the active knife along the rows of root crops and the transverse movement of the knife along the head of the root crop.

These speeds are related to each other by the time of moving the knife in the longitudinal direction in the transverse direction. The solution to this problem is possible due to the development of functional dependencies that describe the process of simultaneous movement of the active cutter knife in these two directions.

and discussion. To justify the constructive and kinematic parameters of the active knife 4 (Fig. 1) of the cutter of the remains of the chicory root heads, consider the complex calculation scheme shown in Fig. 2.

The picker module, and accordingly, the cutter of the picker's remains and the active knife 2 (Fig. 2) moves along the rows of root crops 1 of chicory with the forward speed \mathcal{G} of the picker's module.

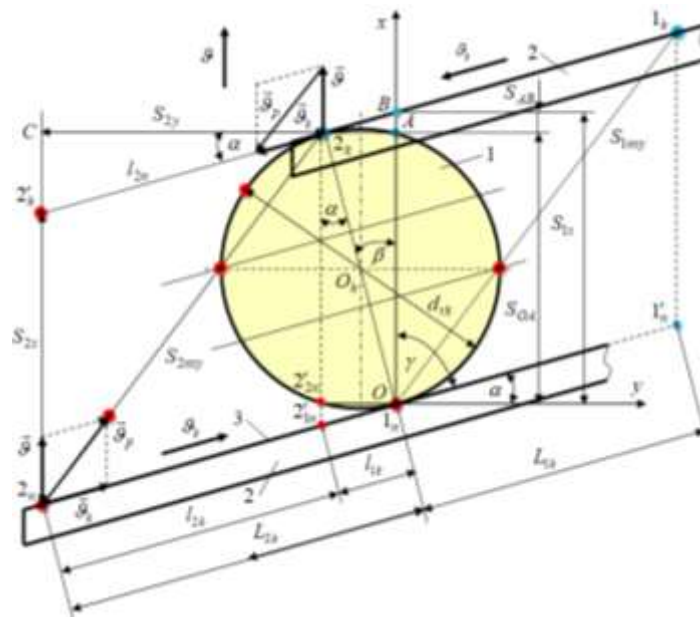


Figure 2. The scheme for calculating the parameters of the active knife of the cutter of the remaining burdock: 1 – root crop head; 2 – active knife; 3 – the cutting edge of the blade of the active knife

At the same time, the passive copier of the cutter of the scallion remains runs over the head of the root crop, copies it, and the active knife 2 (Fig. 2), which performs simultaneous flat-parallel and reciprocating movement (simultaneously moves in the direction of movement of the scallion harvesting module at speed \mathcal{G} and in the reciprocating direction at speed of the active knife \mathcal{G}_k), with the cutting edge 3 of the blade of the active knife cuts off the head of the root crop at the given cutting height.

The necessary quality of cutting the remains of the root crop head will be ensured if the entire plane of the head is completely cut with the simultaneous movement of the cutting edge of the blade of the active knife in two directions and the corresponding coordinated speeds of its movement.

Let the beginning of cutting the head of the root crop 1 (Fig. 2) be at point 1_n , which belongs to the point of the cutting edge 3 of the blade of the active knife, or is at the initial point of contact of the cutting edge of the blade of the active knife of the pruner with the head of the root crop. With the point 1_n , we will connect the fixed coordinate system Oxy , the beginning of which is the point O , while we will direct the Ox axis in the direction of the longitudinal movement of the cutting edge of the blade of the active knife, and the axis Oy – perpendicular to the axis Ox in the direction of the transverse movement of the cutting edge of the blade of the active knife.

Let's formulate the condition of completely cutting off the head of the root crop with the cutting edge of the blade of the active knife of the trimmer of the remains of the pulp from the heads of chicory root crops in the following way.

Complete cutting of the head of the root crop 1 (Fig. 2) by the cutting edge 3 of the blade of the active knife 2 of the cutter of the burdock remains is ensured if, in the horizontal plane of the Oxy , during the movement of the cutting edge of the blade of the active knife along the head of the root crop, or during the cutting of the head of the root crop in the longitudinal direction, which will be denoted by $t_{r,g}$, some point 2_n , which belongs to the cutting edge of the knife blade, is guaranteed to move to the position of point 1_n , or to the point of the cutting end of the root crop head.

At the same time, the time of moving the cutting edge of the blade of the active knife from point 2_n to point 2_k , or the time of moving the cutting edge of the blade of the active knife in the transverse direction, which will be denoted by t_{r,g_k} , was greater than or equal to the time of cutting the head of the root crop in the longitudinal direction during the movement of the cutting edge of the blade of the active knife in the horizontal plane Oxy , i.e

$$t_{r,g_k} \geq t_{r,g}, \text{ or } \frac{S_{2,y}}{g_h \cos \alpha} \geq \frac{S_{2,x}}{g}, \quad (1)$$

where $S_{2,y} = (L_{2n} - d_{rk} \sin \alpha) \cos \alpha$ is the path of moving point 2_n of the cutting edge of the blade of the active knife to point 2_k in the transverse direction or along the Oy axis, m; d_{rk} is the diameter of the head of the root crop in the horizontal cutting plane of the Oxy system, m; L_{2n} is the working length of the active knife between the extreme point of the cutting edge of the blade and the starting point of cutting the head of the root crop, m; α is the angle of installation of the knife relative to the axis of the Oy , degrees; $S_{2,x} = S_{1,x} = S_{OA} + S_{AB} = d_{rk} \cos \alpha + l_{1n} \cos \alpha \cdot \sin \alpha = \cos \alpha (d_{rk} + l_{1n} \sin \alpha)$ – the path of movement of the point 1_n of the beginning of cutting to the point 2_k of the end of cutting in the longitudinal direction or along the Ox axis, m; l_{1n} is part of the working length of the active knife, m.

So:

- the time $t_{r,g}$ of cutting the head of the root crop with the cutting edge of the blade of the active knife from point 1_n of the beginning of cutting to point 2_k of the end of cutting in the longitudinal direction or along the axis Ox is determined by the formula

$$t_{r,g} = \frac{d_{rk} (\cos \alpha + \sin^2 \alpha)}{\frac{dS_x}{dt}}, \text{ or } t_{r,g} = \frac{\cos \alpha (d_{rk} + l_{1n} \sin \alpha)}{\frac{dS_x}{dt}}, \quad (2)$$

where S_x is the path of movement of the picker module during time t , m;

- the time t_{r,g_k} of moving the point 2_n of the cutting edge of the blade of the active knife to the point 2_k in the transverse direction or along the axis Oy is determined by the formula

$$t_{r,g_k} = \frac{(L_{2n} - d_{rk} \sin \alpha) \cos \alpha}{\frac{dS_y}{dt}}. \quad (3)$$

Then according to (1)–(3), we get

$$\frac{(L_{2k} - d_{rk} \sin \alpha) \cos \alpha}{\frac{dS_y}{dt}} \geq \frac{d_{rk} (\cos \alpha + \sin^2 \alpha)}{\frac{dS_x}{dt}}; \tag{4}$$

$$L_{2k} \geq d_{rk} \left[\cos \alpha \left(\frac{dS_y}{dt} / \frac{dS_x}{dt} \right) + \sin \alpha \right]. \tag{5}$$

Dependence (5) will be valid under the condition of ideal placement of the vertical axis of the root crop relative to the longitudinal axis of the $O'x'$ (Fig. 3 a), or the axis of the row of root crops, i.e. under the condition that there is no deviation of the vertical axis of the root crop relative to the longitudinal axis of the $O'x'$, or the axis of the row of root crops.

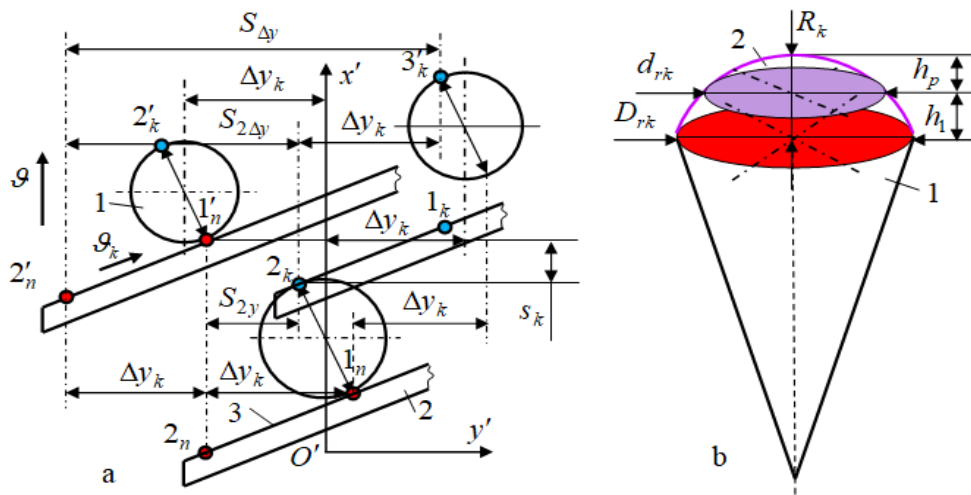


Figure 3. Scheme of deviation of the vertical axis of the root crop from the axis of the row of root crops (a): 1 – root crop; 2 – active knife; 3 – cutting edge of the blade of the active knife; b – a scheme for calculating the height of the cut of the head of the root crop: 1 – the body of the root crop; 2 – root crop head

In the presence of the maximum deviation Δy_k (Fig. 3a) of the vertical axis of the root crop from the axis line of the row of chicory root crops, it can be written that:

- in the presence of the maximum deviation Δy_k of the vertical axis of the root crop 1 (Fig. 3a) in one direction from the axial line of the row of root crops, the length of the path $S_{2\Delta y}$ of the point $2'_n$ of the edge 3 of the blade of the active knife 2 to the point $2'_k$ of the cutting end of the root crop head in the transverse direction or along the Oy axis (Fig. 2) for the time of movement t'_{r,g_k} is equal to $S_{2\Delta y} = S_{2y} + \Delta y_k$;

- in the presence of the maximum deviation Δy_k of the vertical axis of the root crop 1 in two directions from the center line of the row of root crops, the length of the path $S_{\Delta y}$ of the point $2'_n$ of the edge 3 of the blade of the active knife 2 to the point $3'_k$ of the end of cutting the head of the root crop in the transverse direction or along the Oy axis (Fig. 2) in time the displacement of t''_{r,g_k} is equal to $S_{\Delta y} = S_{2y} + 2\Delta y_k$.

Then, in the presence of the maximum deviation Δy_k of the vertical axis of the root crop in two directions from the center line of the row of chicory root crops, we have:

$$\left. \begin{aligned} S_{\Delta y} &= (L_k - d_{rk} \sin \alpha + 2\Delta y_k \sin \alpha) \cos \alpha; \\ t_{r\vartheta_k}'' &= \frac{(L_k - (d_{rk} + 2\Delta y_k) \sin \alpha) \cos \alpha}{\frac{dS_{\Delta y}}{dt}} \end{aligned} \right\}; \quad (6)$$

$$\frac{(L_k - (d_{rk} + 2\Delta y_k) \sin \alpha) \cos \alpha}{\frac{dS_{\Delta y}}{dt}} \geq \frac{d_{rk} (\cos \alpha + \sin^2 \alpha)}{\frac{dS_x}{dt}}; \quad (7)$$

$$L_k \geq (d_{rk} + 2\Delta y_k) \left[\cos \alpha \left(\frac{dS_{y\Delta}}{dt} / \frac{dS_x}{dt} \right) + \sin \alpha \right], \quad (8)$$

where L_k is the working length of the active knife between the extreme point of the cutting edge of the blade and the starting point of cutting the head of the root crop, m.

For further analysis, we express the imaginary size d_{rk} (Fig. 3 b) in terms of the imaginary diameter of the root crop D_{rk} , while we have

$$\pi r_{rk}^2 = \pi h_p (2R_{rk} - h_p), \text{ or } 0,25d_{rk}^2 = h_p (2R_{rk} - h_p), \quad (9)$$

where

$$d_{rk} = 2\sqrt{D_{rk}h_p - h_p^2}, \quad (10)$$

where h_p is the cutting height of the root crop head with the cutting edge of the blade of the active knife at the level of the «sleeping cells», m; R_{rk} is the radius of the root crop head, m.

By substituting the value of d_{rk} from (10) into (9), we will obtain a relationship for determining the working length L_k of the active knife between the extreme point of the cutting edge of the blade and the starting point of cutting the head of the root crop

$$L_k \geq 2 \left(\sqrt{D_{rk}h_p - h_p^2} + \Delta y_k \right) \left(\frac{\vartheta_k}{\vartheta} \cos \alpha + \sin \alpha \right). \quad (11)$$

In Fig. 4 and Fig. 5 shows the dependence of the change in the working length L_k of the active knife, respectively, as a function of $L_k = f_L(D_{rk}; \vartheta_k)$ and $L_k = f_L(\vartheta_k)$.

At the same time: $h_p = 0.005$ m; $\Delta y_k = 0.05$ m; $\alpha = 30$ degrees was accepted under the condition of effective cutting of root crops according to [1].

Based on the analysis of graphical dependencies of Fig. 4 and Fig. 5, it can be stated that the working length L_k of the active knife of the cutter of the remains of the burdock from the heads of root crops is in the range from 0.25 to 0.3 m, subject to the maximum permissible deviation $\Delta y_k = \max$ of the vertical axis of the root crop from the axis of the row of chicory root crops in accordance with the agrotechnical requirements for sowing chicory root crops at the time of collection.

At the same time, the speed of movement of the string harvesting module $\vartheta = 1.6...2.2$ m/s, while the speed of movement of the cutting edge of the blade of the active knife is within $\vartheta_k = 0.3...0.8$ m/s.

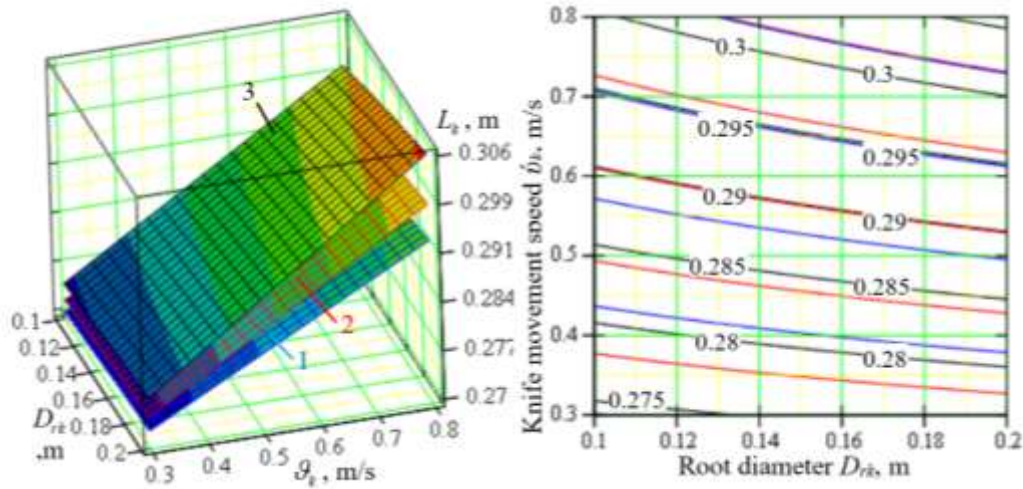


Figure 4. Dependence of the change in the working length of the active knife of the cutter of the remains of the burdock from the heads of root crops as a function of $L_k = f_L(D_{rk}; \vartheta_k)$ 1, 2, 3 – $\vartheta = 1.6; 1.9; 2.2$ m/s

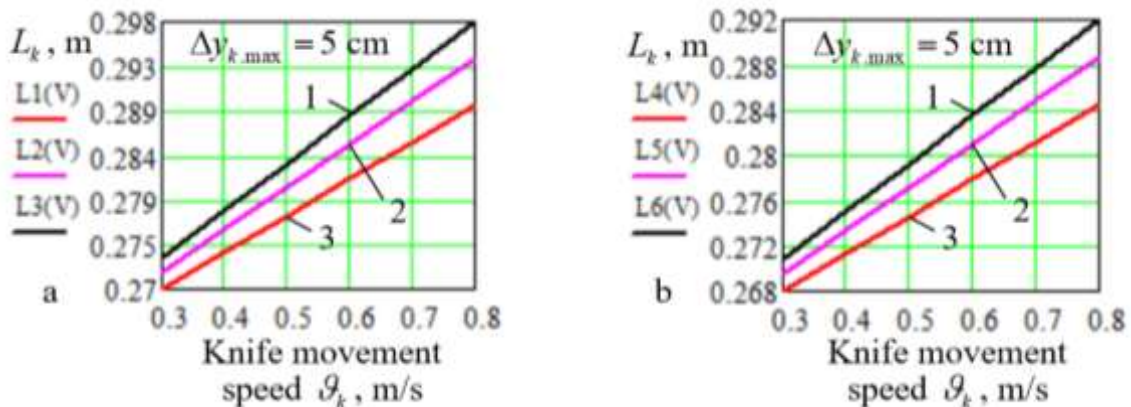


Figure 5. The dependence of the change in the working length of the active knife depending on the speed of the knife movement as a function: a, b – respectively, 1.6; 1.9 m/s; 1, 2, 3 – respectively, $D_{rk} = 0.1; 0.12; 0.14$ m

It should also be noted that the change in the diameter of the root crop in the range of $D_{rk} = 0.1...0.2$ m and the speed of movement of the active knife in the range of $\vartheta_k = 0.3...0.8$ m/s has an insignificant effect on the change in the working length L_k of the active cutter knife residues of the pulp from the heads of root crops – with an increase in D_{rk} and ϑ_k , the working length of the knife increases on average by 0.005 and 0.02 m, Fig. 4.

Denoting in (8) the ratio $\frac{dS_y}{dt} / \frac{dS_x}{dt} = \frac{\vartheta_k}{\vartheta} = K_k$, where K_k is the coefficient of the kinematic mode of operation of the active knife of the cutter of the remains of the burdock from the heads of root crops, we obtain

$$L_k \geq 2 \left(\sqrt{D_{rk} h_p - h_p^2} + \Delta y_k \right) (K_k \cos \alpha + \sin \alpha), \quad (12)$$

or

$$K_k \leq \frac{L_k}{2 \cos \alpha \left(\sqrt{D_{rk} h_p - h_p^2} + \Delta y_k \right) (1 + \sin \alpha)}. \quad (13)$$

In Fig. 6 shows graphical dependences that characterize the limits of the change in the coefficient K_k of the kinematic mode of operation of the active knife of the cutter of the remains of burdock from the heads of root crops depending on the change in the working length of the active knife and which are constructed according to (13). The coefficient of the kinematic mode of operation of the active knife of the cutter of the remains of the burdock from the heads of root crops varies from the minimum value of $L_{k.min} = 1.18$ (at the minimum value of the working length of the active knife $K_{k.max} = 0.25$ m) to the maximum value of $K_{k.min} = 1.61$ (at the maximum value working length of the active knife $L_{k.max} = 0.3$ m).

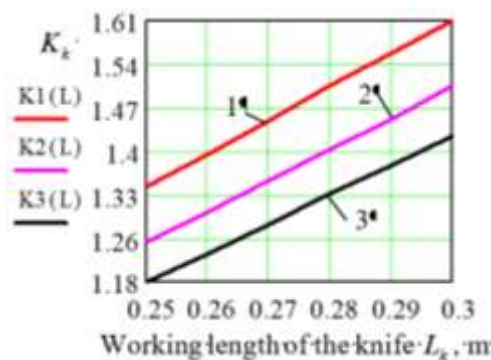


Figure 6. Dependence of the change in the coefficient of the kinematic mode of operation of the active knife of the cutter of the remains of burdock from the heads of root crops as a function of $K_k = f_k(L_k)$: 1, 2, 3 – respectively, $D_{rk} = 0.1; 0.15; 0.2$ m

One of the important characteristics of the process of cutting the heads of root crops with the cutting edge of the blade of the active cutter knife is the value of the time interval from the end of cutting the head of the root crop at point 2_k (Fig. 3 a) to the beginning of cutting the next (adjacent) root crop at point $1'_n$, or the time spent by the knife along the stirring path S_k .

Let's denote this time interval by t_{S_k} , while the path S_k is nothing but the average distance between two adjacent roots in a row.

In addition, for high-quality cutting of root crops, the condition must be met – the time t''_{r,g_k} of moving the extreme point 1_k (Fig. 3 a) of the cutting edge of the blade of the active knife after the end of cutting the previous root crop to the extreme point $1'_n$, or the beginning of cutting the next (adjacent) root crop at point 2_k , was not less than the time interval from the end of cutting the head of the root crop at point 2_k to the beginning of cutting the head of the next (adjacent) root crop at point $1'_n$ or the time of passing the average distance S_k between two adjacent root crops in the row, i.e. time t_{S_k}

$$t''_{r,g_k} \geq t_{s_k}, \text{ or } \frac{S_{\Delta y}}{g_k \cos \alpha} \geq \frac{S_k}{g}, \quad (14)$$

where t''_{r,g_k} is the time of moving the point 1_k of the cutting edge of the blade of the active knife to point $2'_n$ in the transverse direction or along the Oy axis, s; t_{s_k} is the time of moving point 2_k (the end of root crop cutting) to point $1'_n$ of the beginning of cutting the next (adjacent) root crop in the longitudinal direction or along the Ox axis, s.

According to the second equation (9) and condition (14), we have:

$$t''_{r,g_k} = \frac{(L_k - (d_{rk} + 2\Delta y_k) \sin \alpha) \cos \alpha}{\frac{dS_{\Delta y}}{dt}} \geq t_{s_k} = \frac{S_k}{\frac{dS_k}{dt}}; \quad (15)$$

$$t''_{r,g_k} = \frac{\left[L_k - 2 \left(\sqrt{D_{rk} h_p - h_p^2} + \Delta y_k \right) \sin \alpha \right] \cos \alpha}{g_k} \geq t_{s_k} = \frac{S_k}{g}. \quad (16)$$

In Fig. 7a shows the dependence of the change in time t_{s_k} on the distance between root crops in a row as a function of $t_{s_k} = f_t(s_k)$, in Fig. 7b – the dependence of the change in time t''_{r,g_k} as a function of $t''_{r,g_k} = f_{t''}(g_k)$.

Time t_{s_k} , or the time of moving the point of the cutting edge of the blade of the active knife from the end of cutting the root crop to the starting point of cutting the next (adjacent) root crop, with changes in the distance S_k between adjacent root crops in the range from 0.25 to 0.35 m and the movement speed g of the picker module from 1.6 to 2.2 m/s is from 0.11 to 0.22 s (Fig. 7 a).

According to Fig. 7b, it can be stated that the condition $t''_{r,g_k} \geq t_{s_k}$ according to (15) is fulfilled for the value of $0.3 \leq g_k \leq 0.6$ m/s and the working length of the active knife $L = 0.3$ m, fig. 2.19b. At the same time, the value of the diameter of the root crop $D_{rk} = 0.1...0.2$ m does not significantly affect the change in time t''_{r,g_k} .

Conclusion. On the basis of the graph-theoretical analysis of the technological process of trimming the remains of the bran from the heads of chicory root crops and the condition of the maximum permissible deviation of the vertical axis of the root crop from the longitudinal axis of the row of root crops, it can be stated that:

- the working length of the active knife of the cutter of the remains of sedges from the heads of root crops is in the range from 0.25 to 0.3 m at the speed of movement of the sedge harvesting module in the range of 1.6...2.2 m/s and the speed of movement of the cutting edge of the blade of the active knife in the range 0.3...0.8 m/s;

- high-quality cutting of the root crop heads is performed under the condition that the time of moving the extreme point of the cutting edge of the blade of the active knife after the end of cutting the previous root crop to the extreme point, or the start of cutting the next (adjacent) root crop at the point, was not less than the time interval from the end of cutting the root crop head to the beginning of cutting the head of the next (adjacent) root crop, or the time of passing the average distance between two adjacent root crops in a row;

- this condition is ensured at the speed of movement of the active knife from 0.3 to 0.6 m/s and the working length of the active knife of 0.3 m.

The results of studies that substantiate the technological process of the active knife of

the cutter of the remains of the gorse can be sucked in to optimize the structural-kinematic and technological parameters of the transport-technological systems of self-propelled bunker harvesters, which are built according to the block-modular system of layout of the general structural scheme of root-harvesting machines.

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КІНЕМАТИЧНИЙ АНАЛІЗ РУХУ АКТИВНОГО НОЖА ОБРІЗУВАЧА КОРЕНЕПЛОДІВ ЦИКОРІЮ

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Резюме. Коренеплоди цикорію є цінною технічною та стратегічно-важливою культурою для провідних галузей економіки України. Переробка сировини з коренеплодів цикорію дозволяє отримувати продукти енергетичного (біопаливо), харчового (кава) та фармацевтичного (інулін) характеру. Низький рівень механізації збирання коренеплодів і, особливо, збирання як і гички, так і коренеплодів цикорію (значні втрати, пошкодження) не дозволяє забезпечувати потреби сировини для її переробки, або необхідне забезпечення харчової галузі економіки України та кормової бази тваринництва за рахунок збільшення обсягів вживання коренеплодів цикорію. Одним із резервів підвищення показників якості роботи машин для збирання коренеплодів цикорію є поліпшення технологічного процесу збирання гички шляхом застосування удосконалених основних робочих органів – роторного гичкоріза та обрізувача залишків гички з головок коренеплодів. Метою роботи є підвищення показників технологічного процесу збирання гички коренеплодів цикорію шляхом розроблення та обґрунтування параметрів робочих органів обрізувача. На основі проведеного теоретичного аналізу процесу переміщення активного ножа обрізувача по головці коренеплоду розроблено аналітичні залежності, які функціонально описують процес переміщення активного ножа обрізника по головці коренеплоду, що дозволило обґрунтувати основні конструктивні та кінематичні параметри активного ножа обрізувача. Встановлено, що робоча довжина активного ножа обрізувача залишків гички з головок коренеплодів знаходиться в межах від 0,25 до 0,3 м за умови максимального допустимого відхилення вертикальної осі коренеплоду від осі рядка за швидкості руху гичкозбирального модуля від 1,6 до 2,2 м/с та швидкості переміщення ріжучої кромки леза активного ножа в межах від 0,3 до 0,8 м/с. Отримані результати наукових досліджень, які обґрунтовують технологічний процес переміщення активного ножа обрізувача залишків гички з головок коренеплодів цикорію, є передумовою оптимізації конструктивно-кінематичних і технологічних параметрів транспортно-технологічних систем сучасних самохідних коренезбиральних машин.

Ключові слова: коренеплоди, головка коренеплоду, процес, копір, різання, модель, параметри.

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