AGRICULTURAL ENGINEERING SOLUTIONS
ISSN: 2181-399X Volume 1, Issue 1, 2023

CONTRAST INDUSTRIAL CORN KERNEL AND CORN SEED FOR SOWING

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Abstract. In this article it is desribed that, it is necessary to harvest the matured crop of corn at low cost and on time to produce qualitative seed. Therefore, research was conducted about the determination of the maturing period of the corn in the period of waxy maturity of the corncob and physical-mechanical properties of the corn were studied too, for comparing industrial grain and corn for seeding. It was defined that during the experiment the corn may be harvested in its waxy matured period, namely two weeks earlier than maturing completely for producing industrial grain in Uzbekistan. However, this harvesting method can not be used to produce corn for seeding. If the corn-crop is harvested earlier for producing industrial grain, there might be an opportunity to do next agronomic and mechanized operations such as ploughing or providing the field with organic fertilizers before snowy days. But, for producing corn-seed, of course, the completely ripening period of the corn-grain should be waited. Studying the physical-mechanical properties of the corn is important to determine the parameters of the corn-harvester and thresher machines for harvesting seed-corn.

Key words: kernel of corn, seed, grain, ripening dynamics, pod-corn, corncob, corn mass.

Introduction. In many countries corn is grown as one of the main plants at present time. The main reason is that corn is an important forage plant for development of livestock and poultry-ranch [1-7]. Also, another reason is that the products are produced by the corn for use in the food industry, medicine, and technical purposes. Those products are pop-corns, canned-foods, starch, crystallized sugar, alcohol, and other products [8-10].

The motherland of corn is the country of North America. It is known that, by the conclusive evidence of archaeological and botanical scientists' observations, corn was grown as a cultural plant in the southwestern part of the United States of America 3013 years ago. Wild corn was once thought to have existed in the "Tehuacn" Valley of southern Mexico 7013 years ago, and corn growing began for cultural purposes in this region 4613 years ago. Corn is produced at more than 500 million tons at present day all over the world, and the United States is the leader as a corn-growing country, with more than 40 percent of the world's production. Most of its crop is grown in the Midwestern region known as the Corn Belt, which comprises Ohio, Indiana, Illinois, Iowa, Missouri, Kansas, and Nebraska. The other leading corn-growing nations are China, Brazil, Mexico, Russia, Italy, India, and other countries [11].

In Uzbekistan, corn is grown only on the main corn area, but after harvesting wheat crops [12], corn with other crops is seeded on the wheat field as a second crop in Uzbekistan and after wheat harvesting, only early-maturing and middle-maturing corn sorts are seeded. The early-maturing corn is ripened between 70-75 days and the middle-maturing corn is ripened between 90-95 days in our

Republic.

If we take it into account, instead of wheat growing in an empty area, this indicator will increase to 300000 hectares. One of the biggest tasks is growing corn for seed. It is required to harvest the ripped crops without loss and qualitatively. In particular, if this work is performed with the help of mechanization methods and technical instruments, we'll achieve decrease in serious labor and material expenses.

Nowadays, a complex of harvesting machines and earlier-harvesting technology are being produced for harvesting seed-corn in Uzbekistan. Research is being conducted into the creation of the corn-harvester machine and corn-thresher machine. For determination of the parameters and modes of operation of the worker-elements of the created machines, it is necessary to know the maturing period of the crop and its physical-mechanical properties. Therefore, we determined the maturing period of the crop and the physical-mechanical properties of the corn for harvesting corn-seed.

Materials and methods. According to experience of world researchers, the harvesting methods which are in grain form or in pod-corn form are used to harvest corn for industrial grain.

The corn stalks are reaped by the combine-harvesters for cropping the corn for grain. The corncobs are picked from their stalks and they are threshed by the combine-thresher. The grain is separated. This method is very thrifty, but for this method the corn has to be ripened completely. Its moisture should be between 22-26 per cent [3].

In Uzbekistan, this method is used in very few areas, because the stalk of the corn is used as coarse hay for cattle animals. The vegetation period is long (120 days) and the corn that is seeded after wheat as a repeatedly crop can not dry well. Furthermore, only the grain part of the corn is harvested by this method, and the stalk part of the corn is strewed on the surface of the field as humus (organic fertilizer). And this causes not to be harvested the forage that is used as coarse hay for cattle animals.

Nowadays, some new harvesting methods are being researched to settle these defects of the above-mentioned methods [3]. However, in Uzbekistan, these harvesting methods can not be used because the cost of energy is too high and the machines that are used for doing these operations are very expensive.

The corn is harvested as a formed corncob in two forms, namely, husks are peeled from their pod-corns or without peeling the husks. This method is done with the help of corn harvester machines or combines. At first, the stalks of the corn are reaped, pod-corn is stripped and stalks are cut. The silo is unloaded onto transport that is moving on the side of the combine. And corn-cobs are peeled from their husks or they are unloaded without being peeled onto a trailer that is joined to the transport. This method is much better than others in Uzbekistan because the grain of the corn and its stalks are harvested and the pod-corn might be harvested when its moisture is 35-40 per cent.

Therefore, the research was performed on earlier harvesting of the corn crop in pod-corn form. At first, it was explored for studying the maturing period of the corn crop for producing industrial grain. Then the results were analyzed to determine the physical-mechanical properties of corn-cobs and stalks to compare corn grain for seeding. The research was observed by sorts of corn that are most grown in Uzbekistan, namely Uzbekistan-100 and Qorasuv-350 ABM sorts.

Results and Discussions. The results showed that studying the maturing dynamics of grain of the sort Uzbekisatn-100 from 4 September to 1 October (figure 1), the moisture of the grain changed from 68.6 per cent to 17.0 per cent during that period. The milk period of the grain went on until 2

September, and it consisted of 12 days. The paste period, namely decreasing the moisture from 56.2 per cent to 39.0 per cent, continued from 10 September to 16 September, and it lasted 7 days. The waxy ripening period of the grain, namely the decreasing of the moisture from 40 per cent, started on 15 September. On 28 September, it reached 18.2 per cent and ripened completely. So, at that time, the waxy ripening period of the corn consisted of 14-16 days.

As if this situation, it was defined as an early maturing sort of corn which is named Qorasuv-350 AMB too. However, the waxy ripening period of this sort, namely the decreasing interval of the moisture from 40 per cent to 20 per cent, was observed from 11 September to 23 September and that period was organized for 11-12 days. It is seen that by experiments, the ripening period of the corn from waxy ripening until completely ripening is 14-16 days for late-ripening corn and 10-12 days for early-ripening corn.

During the experiments, the changing of the drying dynamics was defined of the pod-corns that were harvested in different periods and dried in shade and in sun light. The results of the experiment showed that (figure 2), the moisture of the sort Uzbekistan-100 of corn was 40.8 per cent on 15 September, namely it was harvested in the waxy ripening period, and dried from 15 September to 11 October, the mass of the corncob decreased from 316 grams to 187 grams. The mass of the dried corncobs decreased sharply from 316 grams to 207 grams from 15 September to 27 September. It decreased from 207 grams to 190 grams from 27 September to 3 October. When it was observed from 3 October to 11 October, it decreased to 187 grams, almost did not change.

As if this experiment was not enough, another one was performed with sort of corn which is named Qorasuv-350 AMB. So, the moisture of this sort was about 40 per cent on 11 September. This sort of corn was harvested on 11 September because it had already ripened into a waxy form and the change of the mass was observed by 11 October.

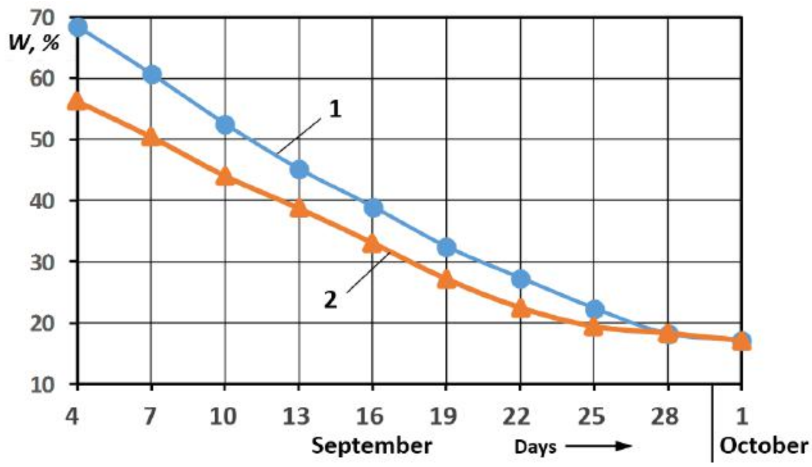

Figure 1. The ripening dynamics of the ear of corn. 1 - the sort of Uzbekistan-100; 2 - the sort of Qorasuv–350 AMB, W – Moisture of the grain.

On 11 September, the average mass of the corncob was 247 grams. It decreased sharply to 154 grams by 1 October. Between 1-5 October, it decreased from 154 to 149 grams, from 5 October to 9 October it decreased insignificantly to 146 grams, then did not change, just remained constant.

The result of the experiment shows that the late-ripening corn that is harvested in its waxy ripened period dries for 18-20 days. When early-ripening corn is dried in natural condition, it is dried for 14-15 days and moisture decreases by 18 percent. It can be ready for threshing and use in industrial aim.

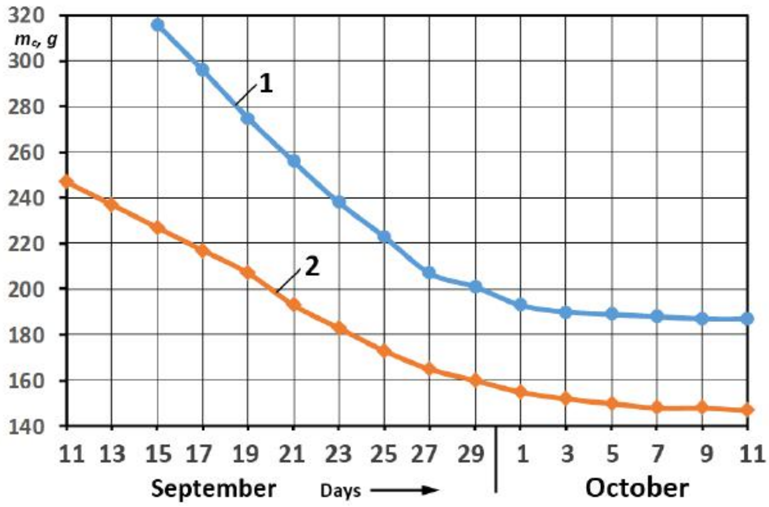

Figure 2. The line graph shows the change of the corn mass that was harvested day by day. It was dried in a shaded place and the sun shone. 1-the sort of Uzbekistan-100; 2-the sort of Qorasuv–350 AMB

This change is in good agreement with the results of K. Astanakulov's research on wheat. After defining the maturing period of the crop, we studied the physical and mechanical properties of the corn. The experiments were tested by early-maturing sorts "Qorasuv-350 AMB" and "Uzbekistan-100", late-maturing hybrid sorts of corn. These sorts are grown mostly in our Republic. The size-mass indicators were determined of those sorts before harvesting the crop. These indicators are shown in (table 1 and table 2); they are average-Mave., average-square deviation- and coefficient variation-V. The results show in the process of harvest, the height of the corn stalk is an average of 192.7 – 257.0 cm, the diameter of the stalk is 13.2 – 20.9 mm.

Table 1. Indicators of the early-maturing sort “Qorasuv-350 AMB”

Name of indicators	Amount of indicators		
	Mave.	$\pm\sigma$	V, %
Common weight of the stalk, g	378.6	252.4	57.2
Weight of the corncob with husk, g	153.4	128.2	49.8
Height of the stalk, cm	192.7	37.3	19.3
Diameter of the stalk, mm	13.2	3.2	34.7
Distance from land till corncob, cm	80.3	18.0	22.4
Length of the pod-corn, cm	18.3	5.7	31.2
Diameter of the pod-corn, mm	38.9	6.0	15.4
Quantity of the leafs, piece	9.1	1.3	14.7

The position of the corncobs from land is at 80.3-123.6 cm height and this indicator is necessary to determine the height of the corncob picker-apparatus of the corn-harvester. The pod-corns are harvested by the help corn-harvester machine and threshed, separated by the help corn-thresher machine. For substantiation of the parameters of the corn-thresher machine, the size-mass indicators were learned from the corncob and those indicators are shown in (table 3).

Table 2. Indicators of the late-maturing sort “Uzbekistan-100”

Name of indicators	Amount of indicators		
	Mave.	$\pm\sigma$	V, %
Common weight of the stalk, g	447.9	245.4	51.2
Weight of the pod-corn, g	197.5	130.2	65.9
Height of the stalk, cm	257.0	43.2	17.1
Diameter of the stalk, mm	20.9	4.2	20.2
Distance from land till corncob, cm	123.6	39.3	31.8
Length of the pod-corn cm	24.32	9.34	38.4
Diameter of the pod-corn, mm	39.81	12.46	31.3
Quantity of the leafs, piece	13.06	1.48	11.37

It is known that, from learned results, every indicator of the corncob has its own amount and self character. They also deviation from the middle amount. The length of the corncobs with husks is an average of 262.5 mm, the average deviation is 44.7 mm, and their diameter is 5.2 mm deviated and they are organized into 38.6 mm.

We analyzed the distribution area of the taken results and we determined their characterizations of the spread distance were smooth. We can see the non-smooth distribution of the amounts by weight of corncob, its grain and of the piths. These indicators are average amounts of 122.1 g, 99.3 g and 22.8 g. Their variation surfaces are 42.1 % on corncobs and their pith. The grain weight is 44.7 %. The result showed that the deviation of the amount is serious one from the other.

Table 3. Size-mass indicators of the corncobs

Name of the indicators	Amount of the indicators		
	M_{ave}.	$\pm\sigma$	V, %
Length of the corncobs with together husks, mm	262.5	44.7	17.0
Diameter of the corncobs with together husks, mm	38.6	5.2	13.6
Weight of the corncobs with together husks, g	130.6	51.2	38.9
Quantity of the husks, pieces	6.2	1.9	30.7
Weight of the husks, g	8.5	3.3	38.9
Length of the husks, mm	216.5	35.8	16.5
Weight of the corncob, g	122.1	51.4	42.1
Length of the corncob, mm	208.7	42.7	20.5
Diameter of the corncob, mm	37.6	4.5	12.1
Weight grain of the corncob, g	99.3	44.4	44.7
Weight of the pith, g	22.8	9.6	42.1
Diameter of the pith, g	24.2	3.1	13.0

There are husks of the corncobs average-amount 6.2 pieces and the weight of the husks is 8.5 g. Their deviation from the average-amount is equal to the amount of the husk 1.9 pieces and the weight of the husks 3.3 g. The husks are situated near 120o at an angle and those husks wrap around 4-5 times the compact thickness of the corncob.

After peeling the husks of the corncobs, their length is an average of 208.7 mm, their diameter is 37.6 mm, and their average-square deviation is equal to length of 42.7 mm, at diameter of 4.5 mm.

The length is 20.5 per cent, the diameter is 12.1 per cent. The corncob with husk consists of husks 6.5-7.0 per cent, grains 76 per cent, and piths 17 per cent.

The weight of the grains of the corncobs was 99.3 g, their deviation from the average was 44.4

g. One of the main indicators is the weight and diameter of the pith. They are shown in table 3. They equal the diameter of the pith at 24.2 mm, their weight is 22.8 g and the deviation from average-amount of the indicators equals the diameter of the pith at 3.1 mm, their weight is 9.6 g.

They are being seen by definite results. The main weight of the husk-corncobs is grains, 75.8 per cent, piths 17.7 percent, and husks, 6.5 per cent. The diameter of the pith is smaller at 13.4 mm than on peeled corncobs and corncobs with husks at 14.4 mm. The main sizes of the grain are length, width, and thickness. These indicators were learned by experiment.

It is known that by experiment, the main size of the grain is length and it changes from 8.4 mm to 10.5 mm. More than 80 per cent of the grains are from 9 mm to 10 mm. The middle length is 9.73 mm, their middle-square deviation is 0.50 mm (table 4). The size of the width grain is near to its size length. It equals 8.34 mm, their middle-square deviation is 0.67 mm, and their variation surface is 8.05 percent.

The smaller size of the corn grains is its thickness. It is equal to an average of 5.16 mm, middle-square deviation of 0.46 mm, and variation coefficient of 9.02 percent. It is seen from the results that the grain length is more than 1.39 mm than the grain width. This difference is more than 4.57 mm than the grain thickness.

Table 4. Sizes of the corn grain

Sizes of the grain	Mave.	$\pm\sigma$	V, %
Length, mm	9.73	0.50	5.14
Width, mm	8.34	0.67	8.05
Thickness, mm	5.16	0.46	9.02

The husk-corncobs are moved around the worker-surface across and down of the corn-thresher machine. The corncobs are rubbed with worker-surfaces. Therefore, we must learn their friction coefficient. It is known that from experiments (table 5), there is a difference between the friction angle of the husk, pith and grain.

Table 5. Rubbing angle of the component corncobs

Sample	Movement way	Friction angle		
		Mmid	$\pm\sigma$	V, %
Husk	across	23.2	3.3	14.3
	down	22.7	4.2	18.6
Pith	across	13.2	4.0	30.5
	down	19.3	1.5	8.0
Grain	-	21.8	3.5	16.4

Across and down friction angle of the husk near one another equals 23.2^{o} and 22.7^{o}. Also, across and down friction angle of the pith equals 13.2^{o} and 19.3^{o}. It was determined that there is a difference one from another 1.5 times. The friction angle of the grain was average of 21.8^{o}. Its middle-square deviation 3.5^{o} variation degree was 16.4 percent. The analyzing of the taken results showed that the pith has leased to friction angle in the learned samples and it is between 13-19^{o}. This indicator for husk is 22-23^{o} and for grain, it is 21-22^{o}. We may say this. We'll pay attention to these results next for research work and we'll use this information.

After observing experiments about the determination of ripening period and physical-mechanical properties of industrial grain, we decided to compare the above mentioned experimental results with those of producing seed-corn. According to some agronomic researchers' observations, there is a special determination method for harvesting corn-crop for producing seed-corn figure 3.

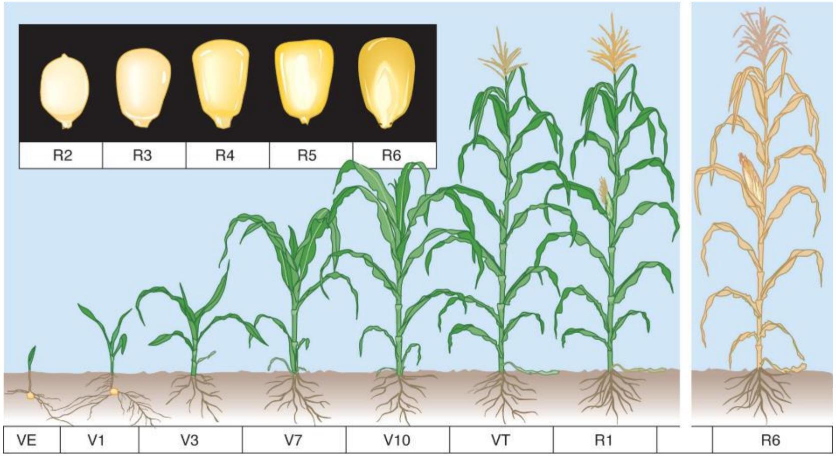

Figure 3. Corn-seed development.

During their research, they defined that matured corn-seed can be known by its color. When corn-seed matures, its color becomes dark-yellow and completely full, as shown in figure 3 R6 position. When we observed the ripening period of the corn for producing industrial corn-grain, it was defined by comparison that most of the grain on the ear became like the R5 position of figure 3 while being harvested. It means that corn-grain which is harvested for industrial purposes is not available for sowing as a seed.

Other researchers' teams determined that, after harvesting pod-corn, corn-seeds should be further sorted in order to have good quality. Some processes should be followed to achieve it. First of all, select cobs of equal size with thick husks, then remove rotten cobs and the cobs which are not completely covered with husk. The next step is to remove the cobs with too big and too small kernels (seeds). Remove the kernels from the top and bottom parts of a cob to select uniform kernels as seed. Removed cobs or kernels (grain) should be used for food consumption, but not for seed. Figure 4.

Figure 4. Selecting qualitative seed.

According to the above mentioned observations, even full matured grains as shown in R6 position of fig. 2 can not be sowed as the seed if they are located on the top and bottom part of the cob. So, many farmers in Uzbekistan and some foreign countries sow corn-seed in R5 and R6 positions. It influences the decrease in the quality of seed and the deterioration of crop productivity.

In addition, there is no mechanized method or machine to harvest and select the exact middle part of the seeds of the cob. This situation demands new research into the condition of Uzbekistan.

Conclusion. According to observed research, the corn may be harvested in its waxy matured period, namely 10-16 days earlier than maturing completely for producing industrial grain in Uzbekistan. The height of the corn stalk is an average of 192.7-257.0 cm. The diameter of the stalk is 13.2-20.9 mm. The position of the corncobs from land is at 80.3-123.6 cm height and these indicators are very necessary for determining the height of the corncob picker-apparatus of the corn-harvester. The size of the corn cob is important for creating the mechanisms of the corn-thresher machine. However, industrial grain that is matured as R5 or R6 can not be available to sow. In addition, there is no agricultural machine or equipment that can thresh and separate the grain from the middle part of the corn cob for sowing as seed. It means, additional research should be performed about creating a new type of corn thresher machine that can thresh and separate exactly part of the corn cob.

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AGRICULTURAL ENGINEERING SOLUTIONS
ISSN: 2181-399X Volume 1, Issue 1, 2023

CHARACTERISTICS OF STRIPING COTTON CROP FROM THE SPINDLES OF A VERTICAL-SPINDLE COTTON HARVESTER WITH THEIR DIFFERENT KINEMATIC REGIMES

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Abstract. This article discusses the solutions to the problem of increasing the efficiency of cotton extraction from the spindles of vertical-spindle devices. The possibility of increasing the action time of the striper in cotton wrapping during cotton removal from the spindles using an elliptic spindle drum based on a planetary-grip mechanism is shown. Universal analytical expressions were obtained to determine the limit and time of interaction between the spindle and the spindle with elliptical and circular trajectories of the spindle, and a comparative analysis of the field operation of the cotton-picking machine was carried out in a numerical experiment. Picking cotton from spindles. Some advantages have been shown in the operation of the elliptical drum in the removal zone. In order to more objectively assess the effect of the size of the joints of the elliptical drum mechanism on the efficiency of removing cotton from the spindles, it is necessary to carry out research in the direction of determining the effect of these parameters on the size. Spindle surface processing area by the stripper.

Key words: striping, spindle, round drum, trajectory, elliptical drum, stripper, impact zone

Introduction. The effectiveness of the puller: a vertical-spindle cotton picker in practice, is estimated by counting the percentage of cotton removed from the spindles, relative to the total mass of cotton wound on the spindle in the collection zone. As you know, when the spindle passes by the stripper, its brushes process a certain part of the cotton winding and remove it from the spindles, therefore, from the point of view of theory, the removal efficiency is estimated by the magnitude of the impact zone of the stripper brushes on the winding. In many works of the 70-80s of the last century, devoted to the study of cotton picking from spindles, the size of the impact zone was determined by the central angle on the spindle, within which the brush strips act on cotton [1, 2] and research work on cotton pickers is also ongoing [3-7].

From a theoretical point of view, these provisions, in essence, reflect the process of interaction of the puller with the cotton wound on the spindle. Previously developed graphic, graphic-analytical and Analytical methods for assessing the efficiency of removal allow, to a certain extent, to objectively evaluate the work of the remover in relation to the parameters of other organs. But they are useful only when studying the process of picking cotton from the spindles of a serial-round drum.

Methods. When analyzing the interaction of the stripper brushes with cotton winding, the authors of [1, 2], the initial and final stages of interaction, rightly consider the point of contact of the conditional circles of the stripper and the cotton winding, respectively, when entering and exiting from the impact of the stripper (Fig. 1, points A and B). With such a scheme, it is easy to determine the position of the spindle, which corresponds to the initial and final stages of the impact of the stripper on the winding.

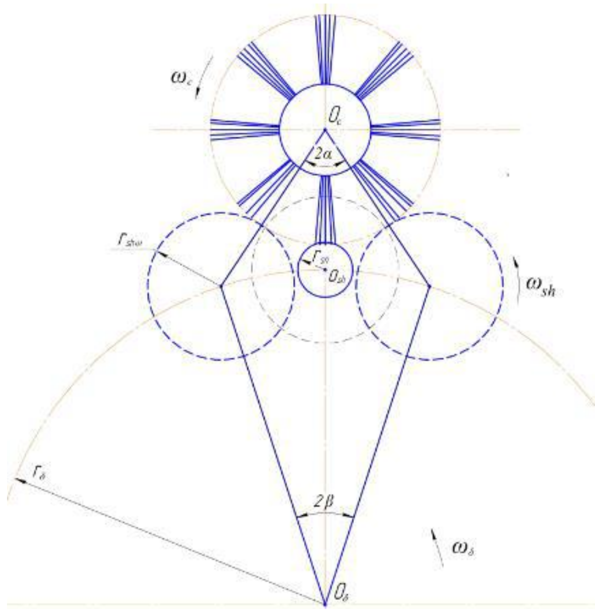

Figure 1. Determination of the impact zone of the stripper on winding cotton in a serial drum

With a non-circular trajectory of the spindle relative to the apparatus, the picture of the interaction of the stripper on winding cotton changes somewhat and this can significantly affect the course of the process of removing cotton from the spindles [8].

It should be noted the variability of the kinematic parameters of the main drum links and some other technical systems based on lever and cam-lever mechanisms. A large number of works have been devoted to the kinematics of such mechanisms. However, we note the works [9], where effective algorithms were obtained for calculating the kinematic and geometric parameters of the actuator.

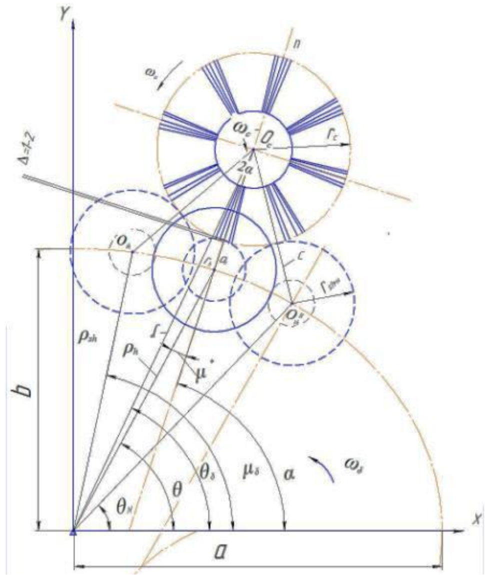

Figure 2. Determination of the zone of impact of the stripper on winding cotton in an elliptical drum

A method is proposed for determining the speed and acceleration of the spindle center in an elliptical drum, which takes into account not only the variability of speed modes, but also the variability of the radius of curvature of the spindle trajectory. This provision must be adopted in this work.

Determination of the impact zone of the stripper on winding cotton in an elliptical drum. We determine the position of the spindle corresponding to the initial and final stages of the impact of the stripper on the winding, when the spindle in relative motion describes an ellipse with the canonical equation

$$y = b \cdot \sqrt{1 - \frac{x^2}{a^2}} \tag{1}$$

where a and b are the major and minor semiaxes of the ellipse.

In this case, we assume that the cotton is wound on the spindle in a ring-shaped manner and the stripper has a cylindrical surface.

As can be seen from the diagram (Figure 2), when the conditional circles of the removable drum and cotton winding come into contact at points A and B,

$$\mathrm{c} = \mathrm{O_{ш}O_{c}} = (r_{ш} + H) + r_c - \Delta \tag{2}$$

where $r_{ш}$ and r_c are the radii of the spindle and stripper; H-thickness of cotton winding; Δ-value of the deepening of the stripper brushes between the spindle teeth, $\Delta = 1 \div 1{,}5$ mm.

In other positions, the distance c takes on the values

$$\mathrm{c} < (r_{ш} + H) + r_c - \Delta \tag{3}$$

The minimum distance between the centers of the stripper and the spindle is obtained when H = 0, and azer.

$$\mathrm{c}_{min} = r_{ш} + r_c - \Delta \tag{4}$$

Therefore, the task is reduced to determining such spindle positions when condition (2) is satisfied. For a straight line segment with at this time, you can write

$$(x - x_c)^2 + (y - y_c)^2 = c^2 \tag{5}$$

where x and y are the coordinates of the spindle center on the elliptical drum;
x_c and y_c - coordinates of the stripper center,

$$\left.\begin{aligned} x_c &= L \cdot \cos\mu_c \\ y_c &= L \cdot \sin\mu_c \end{aligned}\right\} \tag{6}$$

$L = O_{ш}\,O_c$-distance between the centers of the stripper and the origin of the coordinate system (center of the spindle drum); μ_c-angle that defines the position of the stripper relative to the abscissa axis.

Taking into account expressions (6) and (1), equations (5) takes the form

$$(x - L \cdot \cos\mu_c)^2 + \left(b \cdot \sqrt{1 - \frac{x^2}{a^2}} - L \cdot \sin\mu_c\right)^2 = c^2 \quad (7)$$

After some modifications, we get an equation of the fourth degree for *x*:

$$A^2x^4 - 4x^3A \cdot a^2 \cdot L \cdot \cos\mu_c + 2x^2 \cdot [a^2 \cdot (B + L^2)A + +2 \cdot a^4 \cdot L^2 \cdot \cos^2\mu_c + a^4 b \cdot L \cdot \sin\mu_c] - 2x \cdot a^4 \cdot L \cdot (B + L^2) \cdot \cos\mu_c + +a^4 \cdot (B + L^2)^2 - 2a^4a^2b \cdot L \cdot \sin\mu_c = 0 \quad (8)$$

Where $A = a^2 - b^2; \quad B = b^2 - c^2.$

From Figure 2 we define L=L(θ) and $\mu_c = \mu_c(\theta)$.

For the sake of brevity, condition (4) is called “central,” which is shown in the diagram by the angle θ. In a serial cotton picker, when the spindle reaches the "central" position, the axis of the drum, spindle and stripper lie on the same line (Figure 1).

When the spindle center describes a line that differs from the circle, condition (4) is achieved when the circle of the stripper, the spindle and the curve along which the spindle center moves have a common normal *n – n*.

Of $\Delta\, O_{в} O_{sh} O_{c}$

$$L = \sqrt{\rho^2 + (r_c + r_{ш} - \Delta)^2 - 2 \cdot \rho(r_c + r_{ш} - \Delta)\cos(\alpha - \theta)} \quad (9)$$

where ρ is the radius of the ellipse vector; α is the angle of inclination of the normal n – n, determined from the expression

$$\tan\alpha = \frac{y - y_{ц}}{x - x_{ц}} \quad (10)$$

where $x_{ц}$ and $y_{ц}$ are the coordinates of the center of curvature of the ellipse at the point O_{sh} (x_0, y_0):

$$\left.\begin{aligned} x_{ц} &= \left(a - \frac{b^2}{a}\right) \cdot \cos^3\varphi \\ y_{ц} &= \left(b - \frac{a^2}{b}\right) \cdot \sin^3\varphi \end{aligned}\right\} \quad (11)$$

where φ is the parameter of the ellipse associated with the angle θ by the expression

$$\varphi = \arctan\left(\frac{a}{b} \cdot \tan\theta\right) \quad (12)$$

Taking into account (11) and (12), formula (10) can be written

$$\alpha = arc\tan\frac{y - \left(b - \frac{a^2}{b}\right) \cdot \sin^3\left[\arctan\left(\frac{a}{b} \cdot \tan\theta\right)\right]}{x - \left(a - \frac{b^2}{a}\right) \cdot \cos^3\left[\arctan\left(\frac{a}{b} \cdot \tan\theta\right)\right]} \quad (13)$$

Then formula (9) takes the form

$$L = \sqrt{\rho^2 + (r_c + r_{ш} - \Delta)^2 - 2 \cdot \rho(r_c + r_{ш} - \Delta)\cos\left(arc\tan\frac{y - \left(b - \frac{a^2}{b}\right)\cdot \sin^3\left[\arctan\left(\frac{a}{b}\cdot\tan\theta\right)\right]}{x - \left(a - \frac{b^2}{a}\right)\cdot\cos^3\left[\arctan\left(\frac{a}{b}\cdot\tan\theta\right)\right]} - \theta\right)} \quad (14)$$

The angle μ_c is also determined from Fig. 2,

$$\mu_c = \theta + \mu^* \quad (15)$$

where μ^*-is the angle between the polar radius and the straight line connecting the centers of the stripper and the spindle drum; from $\Delta\, O_{ш}O_{в}O_{c}$

$$\mu^* = arcCos\frac{L^2 - \rho^2 - (r_c + r_{ш} - \Delta)^2}{2\rho\cdot L} \quad (16)$$

Together, solving equations (8) and (1), we determine two pairs of roots x_n, y_n and x_k, y_k for each position of the stripper. One of the pairs of roots (x_n, y_n) defines the coordinates of the spindle center, corresponding to the beginning of the stripper impact on the winding, and the second (x_k, y_k) to the end.

By numerically solving equation (8), it is possible to determine for each position of the puller, the common boundaries (coordinates of the spindle center) within which, the puller brushes process the winding of cotton, which makes it possible to study the influence of various factors on the removal of cotton from the spindles during contact with the puller.

Duration of the puller's exposure to cotton. The winding of cotton, passing near the stripper, is under the influence of the stripper for a certain time. The estimated residence time of cotton under the influence of the puller in a serial device is within 0.05-0.06 sec [1, 8, 9], which in some cases is not enough time to completely release the cotton from the spindle [2].

It should be noted that the analysis of the operation of the apparatus with elliptical drums showed (that at different angles of the location of the strippers relative to the drum, it should be noted that the residence time of the cotton in the contact zone with the stripper), the residence time of the cotton in this zone has different values.

As can be seen from the diagram (Fig. 3), the stripper acts on the winding within the line bounded by the points $O_{ш}^{н}$ and $O_{ш}^{н}$, which corresponds to the positions of points D_1 and D_2 of the crank rotating at a constant angular velocity ω_1.

The angle of rotation of the crank from position D_1 to position D_2 can be determined as:

$$\psi_{1,2} = \psi_2(\theta) - \psi_1(\theta) = \omega_1 \cdot t \quad (17)$$

where $\psi_1(\theta)$and $\psi_2(\theta)$are the angles of the crank position, correspond to the beginning and end of the impact on the cotton winding; –The time of turning the crank at an angle $\psi_{1,2}$.

Theoretical time of action of the puller on winding cotton on one spindle

$$t = \frac{\psi_2(\theta) - \psi_1(\theta)}{\omega_1} \tag{18}$$

From Figure 3**.**

$$\left.\begin{aligned} \psi_1(\theta) &= \theta_{\text{н}} + arc\cos\frac{r^2+\rho_{\text{н}}^2+l^2}{2\cdot r\cdot\rho_{\text{н}}} \\ \psi_2(\theta) &= \theta_k + arc\cos\frac{r^2+\rho_k^2+l^2}{2\cdot r\cdot\rho_k} \end{aligned}\right\} \tag{19}$$

where $\theta_{\text{н}}$ and θ_k -are the angles of the spindle center position, correspond to the beginning and end of the impact of the stripper on the winding:

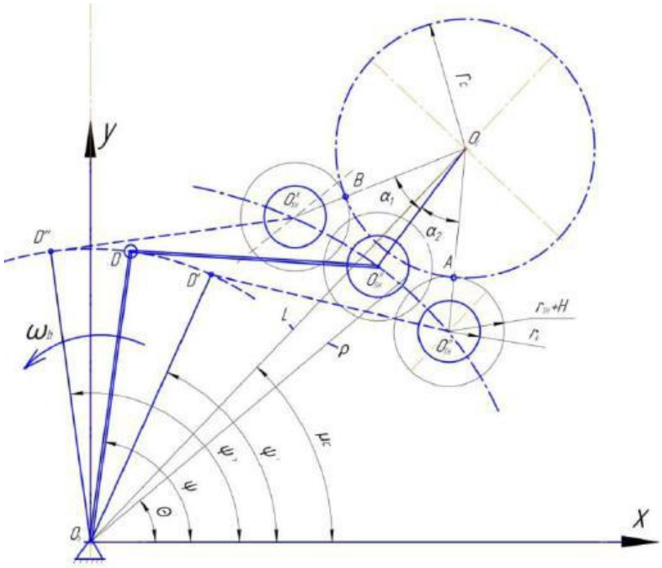

Figure 3. Scheme for determining the impact time of the stripper on winding cotton in an elliptical drum

$$\theta_{\text{н}} = arc\,tan\frac{y_{\text{н}}}{x_{\text{н}}};\;\; \theta_k = arc\,tan\frac{y_k}{x_k};$$

$\rho_{\text{н}}$, $\rho_{\text{к}}$- polar radii, determine the position of the center of the spindle, which corresponds to the beginning and end of the impact; r and l are the lengths of the crank and the connecting rod of the elliptical drum mechanism.

Taking into account (19), the time interval of the impact of the stripper on winding cotton on one spindle, depending on the angle of the stripper position, corresponds to:

$$t = \frac{(\theta_k - \theta_{\text{н}}) + \left(arc\cos\frac{r^2+\rho_k^2+l^2}{2\cdot r\cdot\rho_k} - rc\cos\frac{r^2+\rho_{\text{н}}^2+l^2}{2\cdot r\cdot\rho_{\text{н}}}\right)}{\omega_1} \tag{20}$$

From this it follows that for $\rho_k = \rho_{\text{н}}$ formula (20) takes the form

$$t = \frac{\theta_k - \theta_{\text{н}}}{\omega_1} \tag{21}$$

In fig. 4 shows the results of the machine calculation of the impact time of the stripper on cotton in the form of the dependence $t = f(\mu_c)$for a given conditional winding thickness within H=0÷20,0 mm. The angle of installation of the stripper relative to the longitudinal axis of the elliptical drum changed within $\mu_c = 0 \div \pi$.

The purpose of comparing the time spent by cotton in the contact zone, with a stripper in the apparatus, with serial elliptical drums is the number of revolutions of the drum shaft and the dimensions of the remaining structural elements of the apparatus included in the formula (20) are taken equal to the serial one:

b=0,146 m; $\omega_1 = 105{,}0$ turnover/minutes; r_c=0,05 m; $r_ш$=0,012; Δ=0,001 m.

Semi-major axis a varies within 0.175 ÷ 0.205 m every 15 mm.

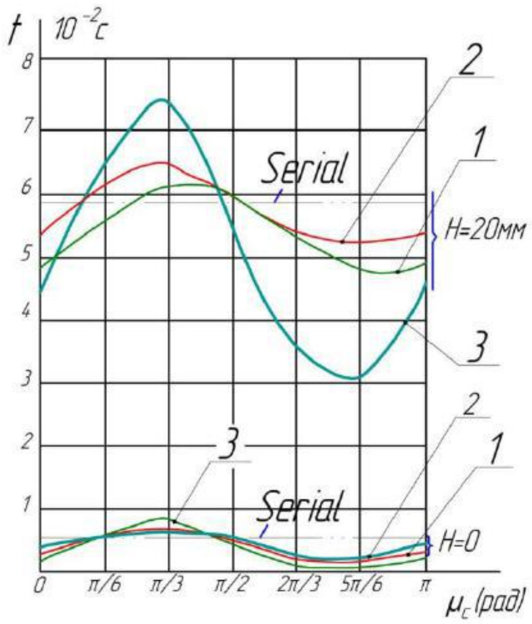

Figure 4. Change in the time of action of the stripper on the winding on the spindle in elliptical and serial drums, depending on the relative position of the stripper: 1–a=0,175 m; 2–0,190m; 3–0,205m;

From the obtained dependences it can be seen that the residence time of the cotton winding on the spindle in the elliptical drum in the contact zone with the stripper is strongly dependent on the angle of the latter. So, when the stripper is installed about $\mu_c = {}^{\pi}/_{3}$, the duration of the spindle being in the contact zone with the stripper in an apparatus with elliptical drums reaches its maximum, and it is more than the serial one, angle which is about $\mu_c = {}^{5\pi}/_{6}$minimum, much less than the serial one. In this case, it is necessary to take into account the influence on this parameter of the magnitude of the semi-major axis (with a fixed value of the semi-minor axis b=0,146 m), as well as the thickness of the cotton winding located on the spindle.

One of the ways to increase the completeness of the removal of cotton from the spindles with a puller is to increase the time spent on the spindle with the cotton winding under the influence of the puller [9].

To assess the difference in the duration of the spindle in the contact zone of the cotton with the stripper in elliptical and serial drums, we denote the difference in percentage:

$$\Delta t = \frac{t_e - t_s}{t_s} \cdot 100\% \quad (24)$$

where t_e and t_s are the duration of the stay of the spindle in the contact zone of the cotton with the stripper, respectively, in the elliptical and serial drums, are determined by formulas (20) and (21).

Using formulas (20), (21), and (22), a numerical experiment was carried out to determine Δt at various values of the major semiaxis: a=0,175 m, 0,190 m, 0,205 m and with a winding thickness H=0 and H=20,0 mm.

From the analysis of the results of a numerical experiment, it follows that by using an elliptical drum on a cotton picking machine, by installing a stripper relative to the longitudinal axis of the drum with an angle $\mu_c = {}^{\pi}/_{6} \div {}^{5\pi}/_{12}$, it is possible to increase the spindle dwell time under the influence of the stripper.

Conclusion. Note the significant influence on the exponent Δt of the value of the major semiaxis of the ellipse a. So, in the absence of winding on the surface of the spindle (H=0) and with a=0,175 m; 0,190 m; 0,205 m and $\mu_c = {}^{\pi}/_{3}$you can reach Δt=20.5%; 26.3%; and 64.7%, respectively. In the presence of winding on the spindle (for example, H=20.0 mm), we have Δt=9.7%; 12.4%; and 29.4%.

For a more objective assessment of the effect of the dimensions of the links of the elliptical drum mechanism on the efficiency of removing cotton from the spindles, it is necessary to conduct research in the direction of determining the effect of these parameters on the size of the processing area of the spindle surface by the stripper.

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AGRICULTURAL ENGINEERING SOLUTIONS
ISSN: 2181-399X Volume 1, Issue 1, 2023

EFFECTIVE UTILISING OF AGRO-TECHNO PARK AND DEVELOPMENT OF TECHNICAL SERVICES SYSTEM

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Abstract. In this article, the system of effective use of agricultural machinery in the park and the improvement of the technical service system and solutions to the problems are presented. For this, the available analysis of the number of agricultural machinery solutions of the Tashkent region, Bekobod districts, especially the park machinery and agricultural technical services with technically modern, highly complex structures, is effective. recommendations and suggestions for improving the use system were given. Technical services of the Republic of Agriculture in joint enterprises with local and districts provide the opportunity to use the machine for effective use in classes that match the size of the field area. Agricultural tractors and high usage and you have to draw conclusions from practice.

Keywords: agro-techno park, technical system, service, storage, database modernization

Introduction. Today's information technology age calculated be observed in all spheres of the economy in the current period of development trends along with the issue of food security to ensure the consistent implementation of reforms that also holds a special place. Therefore, the productive use of irrigated lands in the Republic, offering highly effective techniques and technologies to get high yields from agricultural crops have given particular attention to the introduction of resource efficient. This day needs as important and urgent importance. For the further development of the Republic of Uzbekistan in 2017-2021 years at strategic action, including up to the year 2030 more than two times the size of the gross domestic product increase, the rational use of land and water resources, the introduction of modern intensive agricultural techniques, agricultural technologies from the park in the efficient use of their technical condition of ensuring the stability of the task defined. The fulfillment of these tasks in the agricultural technique of the effective use of the park, is one of the important issues of technical and technological modernization including [1, 2, 3, 4].

Materials and methods. Nowadays foreign and local conditions in the agrarian sector of our Republic is produced in the large amount that results from the use of agricultural techniques. In terms of the quality of the agricultural park of the technique are updated. This technical hydraulics structures, are widely used in automatic control and electronics systems. As a result, the technically modern, the technique which have extremely complex structures of the park system improvements in the effective use of agricultural technical services demand continues [1, 2, 3, 4].

The analysis at the following time and progress in agricultural production in the country and abroad come from the level of use of modern tractor shows that he is not at the required level. Because this high-capacity tractor with the lack of agricultural machines, which fit them for efficient use of energy, and meet the existing standards is not observed. This order and to work out the rules on their use continues to increase the level of demand. On the market, equipped with modern computer systems and technical management to increase the level of preparation of highly qualified specialists of the implementation of the use of the necessity of the presence is being felt also [5, 6, 7, 8].

In foreign countries (USA, UK, Germany) of units and to remotely administer the computer and the operator agricultural bort them at the level of modern requirements, and to create conditions for the implementation of a high level of work is being conducted in this work to prepare highly qualified specialists are established.

It is possible to conclude on the basis of the above information, the park of the level of use of agricultural techniques is not sufficient, as a result of improved agricultural machines full of structures incomplete of the quality of work is not high, the use of technical, management and technical service will demand required improvements at the system level.

The solution of the problem. As it is known, our technical agrarian republic in the field of agriculture production, delivery, service, and technical services technical fellow in the production of agricultural products much single created a system of reciprocal link. Nonetheless, the improvement of agricultural techniques indicators and park their activities is required. Because the park is full of resources agricultural techniques, use of the content ensure that the regulatory requirements at the level of modernization and increase their effectiveness not noticeable. Allocated land for agriculture is not sufficient to ensure the necessary technical with full cover. The park is also the effective use of agricultural techniques from events at the time of their agronomic performance, quality, control units to adjust to fit the requirements of the agronomic use of indicators in the analysis, did not find their own solution many problems such as too full diagnosis and proper storage.

It should be noted that, despite the accomplishments achieved in the area of food security and agricultural development in Uzbekistan, from the earth, in particular the presence of a number of problems in the field of irrigated land use has been recognized, including: water scarcity; effective use of land is not high, agricultural crops optimization (placement) of the earth (acceptable) that are surrounded with the necessary technical provide full; to the ground the main tillage, among a number of processing crops, agronomic not following the rules on the protection complete; timely and quality planting of agricultural crops, maintenance, there are shortcomings in ensuring the timely implementation of measures agronomic protection. There are a number of effective use energy resourceat the same time also disadvantages, namely: relatively low level of labour productivity; high energy intensity of agricultural products for the production of spent (250-280 kg per 1 hectare cultivated area in Uzbekistan, Usa - spending comes on 140 kg fuel), energy that consume them are technical years from the effective use of technical indicators of the use of low (a lot of outdated technical in the balance at the district level, lack of fitness to work). One of the main factors of competitiveness of agricultural products grown so is its energy density. This requires increased attention to the issues of saving resources and energy in agriculture is. In this matter resources efficiently agronomic methods are technical, equipment and equipment to be effective, resource-saving technologies can reduce the negative effects of the introduction of the effects of 20-40 percent. The final result of this course, management and applied technology that depends on the combination of agricultural production acceptable.

Foreign agricultural system technical technical technical innovation to the solution of the problem and existing management systems and their use on the basis of increasing the level of service to create and manage the development of new procedures and rules can be achieved by way of [2, 3, 4, 5, 6, 7, 9, 10]. To do this, from the technical aspects and technological improvement to produce agricultural products, agricultural equipment good technical management, operation of agricultural technical solutions in the technological park parking system, also connected to each other, arranged and requires that they be gathered. Thus, the agricultural activities have the highest benefit of their work for productivity. Maintaining successful working of the economy in modern conditions the following new developmentproductivity requires qualified labor and management. Such a demand in the field of agriculture of ways and means of ensuring "the exact farming"is applying to. "Clearly of farming"to manage the process if it is one of the main elements of the two factors, i.e., to know exactly the tools and processes them pre-likely in the case, monitoring and control will demand [7, 9, 10]. To do this, and technically technological modernization in the republic to produce agricultural crops and agricultural techniques available to get into the park control system, agricultural technical methods an institution that needs the cover of the effective use of agricultural technical services and technical solutions for improvement of the mechanism of the park is the recommended model (Figure 1).

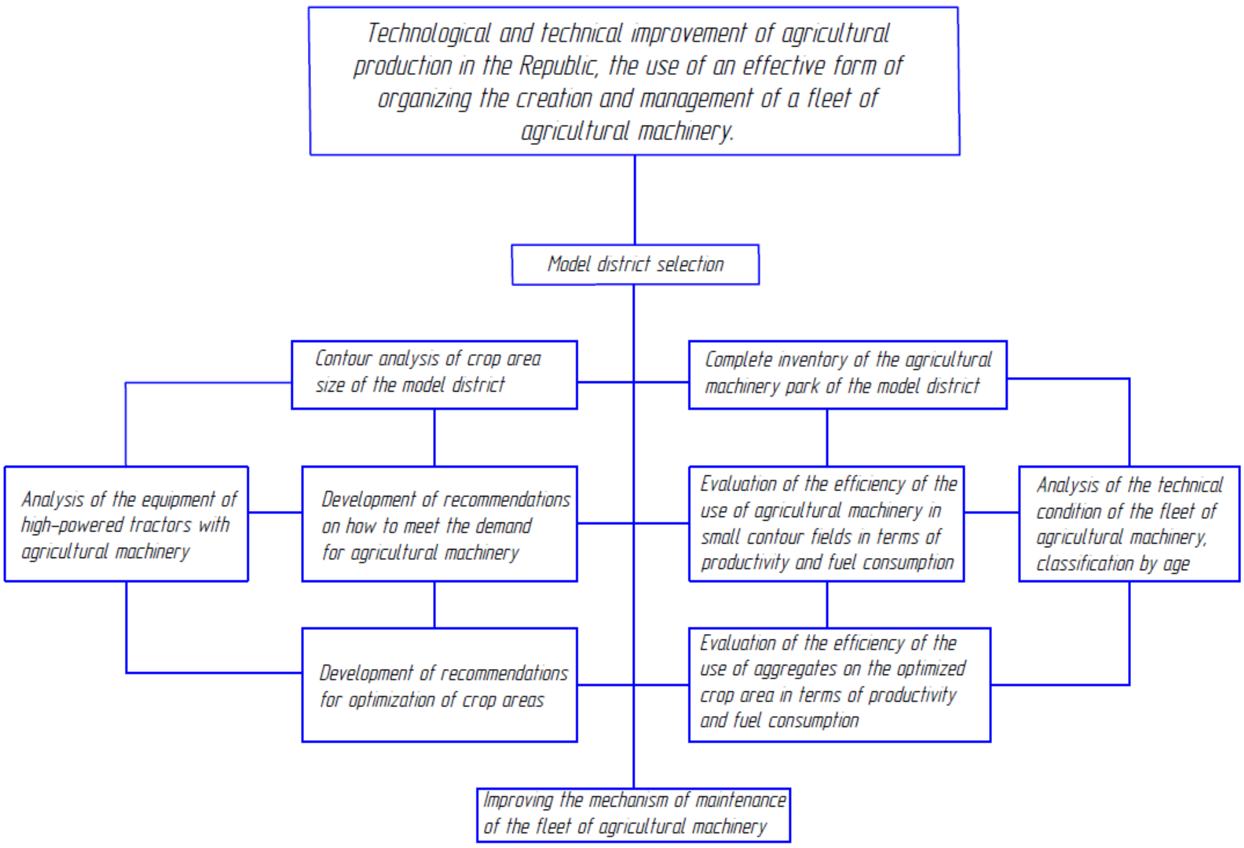

Figure 1. Flowchart of recommended model for effective utilising of agro-techno park

This system technical services (to use the technical implementation of the regulations, maintenance, storage), technical service (dealer) (settled and mobile services), technical implementation recovery (the technical implementation of a system purchase, componentry and re-sales, spare parts sales and exchange), science and production integration (technical innovation and technology, used in the production of the achievements of science and technology) will be offered to the introduction.

Results. Technological improvement from the technical aspects to produce and agricultural products, agricultural equipment good technical management, operation of agricultural technical solutions in the technological park parking system, also connected to each other, arranged and requires that they be gathered. Thus, the agricultural activities have the highest benefit of their work for productivity. Maintaining successful working of the economy in modern conditions the following new developmentproductivity requires qualified labor and management. Such a demand in the field of agriculture of ways and means of ensuring “the exact farming”is applying to. “Clearly of farming”to manage the process if it is one of the main elements of the two factors, i.e., to know exactly the tools and processes them pre-likely in the case demand monitoring and control to will.

This condition has not been fully studied for the conditions of our republic and the solution did not identify. But, at present, provide with their farms by the farmers of particular importance to modern tractors and machines are given.

Acceptable for all of the technical and economic management of the parking system technical technical agriculture of the opening section should be given. They benefit from effective should be used in the manufacture of products at the same time.

Policy based Tashkent region, Bekabad district agricultural technical types and forms of ownership available in the analysis (table 1).

Table 1. Types and forms of ownership of existing agricultural technical Bekabad district

N	Agricultural technical solutions name	“Agroservis” Alternativ tractor parking Llcs, %	Farms	
			Total, %	of the including many in band, %
1	Drivingtractor	14,9	85,1	72,3
2	Universal-mowing tractor	4.2	95,7	87,3
3	Transport a tractor	3,6	rise to 96.3	89,1
4	Graincombines	38,1	61,9	61,9
5	Tractortrailers	5.5	94,4	55,5
6	Seedsplanting, seeding	grows 12,5	87,5	72,2
7	Cotton machine	10.0	-	-
8	Grainplanting, seeding	-	10,0	-
9	Cultivators	58,8	41,2	41,2
10	Thechizel	-	-	-
11	Plow	66,6	33,3	25,0
12	Songsthissnowstorm	-	-	-
13	Thesprayer	30,7	69,2	61,5
14	Mineral opportunities sowing machines	-	-	-
15	Organic fertilizer sowing machines	-	-	-
District total:		18,2	81,57	71,4

Table data analysis shows that are available on the district technical approximately 18,2 % “Agroservis” Alternativ tractor parking Llcs to 81,57 % 71,4 including farms % farms diversified comes on.

Conclusion. Ur service model to create a system for agriculture in the district is pressing republic. n the first place to conduct a full inventory of the technical implementation at the district level, will be worthwhile to divide the year into categories.

The Republic of agricultural technical services produced in joint ventures with local and districts (zones) the size of the field area (surface area, height and width) on the effective use in the classroom that fits their capacity to enable you to use the machine in agricultural tractors and a high level of use and you should base the conclusion from practice.

Spare parts supply, maintenance and repair work to ensure that technical solutions of the low-cost and effective agricultural machines and mechanisms, many of which are concentrated in the park should put an end brand.

At the district level agricultural technical solutions to the park maintenance, repair, and maintain technical services for diagnosis and adapted to the system of birth for the increase of the index will be according to the goals of improvement.

Distribution system technical service guarantee, dealer service development of innovative new technical're getting go out of business, selling to the dealer for warranty service should be done by the implementation of the old techniques.

Specialization for of the service center, delivery mechanisms, it is necessary to develop the necessary components and spare parts.

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AGRICULTURAL ENGINEERING SOLUTIONS
ISSN: 2181-399X Volume 1, Issue 1, 2023

RESEARCH ON DIFFERENT OPTIONS FOR PROCESSING GRAY FOREST SOIL IN A FIELD CROP ROTATION

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Abstract. This article describes the outcomes of the research of different options for the main treatment of gray forest soil at the experimental site of JSC "Lednevo" in the Yuriev-Polsky district of the Vladimir region of the Russian Federation. The experiment consists of 3 variants with an average area of 7.5 ha, 12 lines with reduced processing intensity and replicated 4 times. According to the results of the research, it was found that the main problem with the physical condition of the soil is the significant compaction of the soil at a depth of 20-25 cm. When using waste treatment, an increase in soil heterogeneity was observed, and the presence of weeds was noted in the "minimal" options, which required a change in the strategy of using plant protection agents and strict adherence to crop rotation. This article recommends deep loosening of the soil to a depth of 35-40 cm in the fall, followed by minimal tillage by cultivators to remove the "plough base" and reduce soil compaction.

Key words: gray forest soil, dump technology, seeder, agro-chemical analysis

Introduction. In the climatic regions in Vladimir Opolye of the Russian Federation, there is still no significant practical experience and knowledge about less intensive methods of tillage. Only thanks to the knowledge about the nature of the soil and about the climate, over the past 10 years, as a result of extensive demonstration studies, there has been a tangible development in the field of various options for the intensity of cultivation of gray forest soil [1-3]. The transition from a dump to a non-dump tillage system is associated with a variety of technical possibilities for using equipment and with different soils (light, heavy, wet, dry, cold or warm). In principle, each type of soil and climate zone has its own requirements for the intensity of tillage. The transition from the plow to non-tillage, or to the technology of direct sowing, has a significant environmental and economic effect. Currently, there is no average or overall optimal tillage intensity. The optimal intensity of tillage is based on the conditions of a certain place of cultivation. The specific nature of the soil, its texture, hydro-morphicity, soil structure, humus content, acidity, as well as climate, i.e. precipitation and temperature, determine the optimal intensity of processing.

The literature and patent analysis showed that obtaining high and stable yields in the production of grain crops largely depends on the quality of sowing. In modern conditions, more and more attention is paid to subsurface-scattered sowing, carried out by seeders for direct sowing, which allows by combining pre-sowing tillage with sowing to achieve the best possible supply of plants in the area of sowing at a given depth with nutrients and moisture [4-8].

The operation of the seeders has shown the feasibility of using pneumatic feeding of seed material on them, which contributes to increasing the width of the seeding unit and increasing its productivity. The working bodies of the seeders are foot coulters, but the existing designs of foot coulters do not fully meet the agrotechnical requirements for sowing. The main disadvantages in their work are a small range of seeds in potashnikova space, insufficient width sown strip that leads to a decrease in the uniformity of seed distribution area of the screening at a given depth and requires further improvement of the working bodies for stripe sowing [4-8].

The purpose of the research. Determination of the optimal (minimum) level of the main processing of gray forest soil in the field crop rotation.

Material and methods. The climate of the Vladimir region is moderately continental. A distinctive feature of the spring temperature regime is the rapid rise in air temperature. The average monthly air temperature of the warmest month of the year (July) is about 17°. The sum of active daily temperatures above 10° from the beginning of May to the end of September (125-140 days) is 1900° - 2200°. Annual precipitation averages from 480 to 580 mm. Up to 75% of precipitation falls in the warm season, and 25-30% - in the cold. The soils on which the experiment is located are fertile dark-colored carbonaceous and gray forest-related to broad-leaved forests in the Vladimir " opolye» [1-3].

The experiment consists of 12 strips (Fig. 1), with an average area of 7.5 hectares, and the experiment occupies a total of 90 hectares. The experiment consists of 3 variants, with a decreasing intensity of tillage, and 4 repetitions (blocks from A to D). In selected places are lower realized the appraisal of plants and soil (tab. 1).

Figure 1. Scheme of the experiment. Vladimir region, Yuriev- Polsky district, JSC " Lednevo».

Table 1 - Scheme of the experience of JSC "Lednevo»

Variants	1	2	3	4	5	6	7	8	9	10	11	12
Repeti-tions	A			B			C			D		
Experience	A1	A2	A3	B1	B2	B3	C1	C2	C3	D1	D2	D3
Technology	Plow 20-22 sm	Centaur 15-17 sm	Centaur 8-10 sm	Plow 20-22 sm	Centaur 15-17 sm	Centaur 8-10 sm	Plow 20-22 sm	Centaur 15-17 sm	Centaur 8-10 sm	Plow 20-22 sm	Centaur 15-17 sm	Centaur 8-10 sm

Experience 1 (control). The dump tillage system used in the experimental field includes all the elements that are present in the classical tillage system in the enterprises of the Vladimir region: peeling stubble after harvesting the predecessor to a depth of 5-7 cm, plowing to a depth of 22-25 cm, pre-sowing cultivation in order to create a seedbed, level the surface of the field and conduct reverse compaction.

Experience 2 (minimum). Non-dump - minimum system of soil treatment. In this processing system, plowing is replaced by cultivation to a depth of 15 to 22 cm. This option is positioned as the nearest alternative to dump tillage. In this case, it is not the turnover of the formation (arable layer), but its mixing. The intensity of soil treatment is reduced.

Experience 3 (minimum). The minimum tillage system. The only difference is that plowing is replaced by cultivation to a depth of 8 – 10 cm. Accordingly, the intensity of tillage decreases.

Harvesting of grain crops was carried out by the Claas Mega 250 combine harvester**.**

Results and discussion. At the beginning of the experiment (2009), the field was occupied by perennial grasses of 5 years of use. The scheme of the crop rotation of the experimental field is shown in Table 2.

Table 2. Scheme of crop rotation in the experimental field

Year	2006	2007	2008	2009	2010	2011
Culture	Perennial grasses, % g. p	Spring millet	Winter millet	Oats-Vika on sea-los	Winter wheat	Spring barley

First of all, the weeds were counted, which revealed a strong infestation with perennial weeds (wheatgrass, sedge).

The analysis of the soil profile showed that the structure of the soil in the experimental field is disturbed. There is a clear boundary between the arable and sub-arable layers. There is a "plow sole", formed over many years of working with the plow, and the passage of heavy equipment in the field. The strongest seal was found at a depth of 25-30 cm. (figure 2).

Figure 2. Soil profile studies

In the spring of 2009, the entire area of the experimental field was sown with a grain-grain mixture for silage, with the predominance of the legume component (vetch + oats) in the mixture. Sowing such a mixture can significantly improve the physical condition of the soil. The goal was also pursued, after early harvesting of the mixture for silage, to fight against perennial weeds and engage in cultivation. To destroy negative seals the soil and plow pan was decided to hold the deep loosening of the entire experimental field at a depth of 35 to 40 cm, chisel type "Paraplu".

In the work, an agrochemical analysis was carried out, which revealed a problem with the acidity of the soil (Table 3).

Table 3. Agrochemical analysis of soil

Anrochemical soil analysis, Experimental field 09/14/2019												
pH	P_2O_5 mg/kg	K_2O mg/kg	Ca mg/100g	Mg mg/100g	Organic matter%	B mg/kg	Cu mg/kg	Zn mg/kg	Co mg/kg	Mn mg/kg	S mg/kg	Fe mg/kg
5,50	126,30	77,93	10,96	5,77	4,31	0,44	3,41	0,65	1,13	14,60	10,17	58,67

Blocks A, C seeding rate of 500 germinating grains per m2 (225 kg/ha). Blocks B, D the seeding rate is 400 germinating grains per m2 (190 kg/ha). With high-quality soil preparation, and using band-seeding drills that provide high-quality seedbed preparation, such as Amazone DMC Primera, it is possible to reduce the seeding rate.

It is established that the yield of winter wheat in 2010 on the minimum variants is higher than on the variants with a plow by 0.3-0.45 t / ha. At the same time, the reduction in the seeding rate was also more effective than in the reverse treatment (Table 4).

Table 4. Results of the experiment (2009 – 2010) Culture: Winter wheat – "Moskovskaya 39", 1 reproduction. Predecessor: vetch + oats (removed for silage on 17.07.2009)

Variant	A1, C1	B1, D1	A2, C2	B2, D2	A3, C3	B3, D3
Seeding rate, w / m^2	500	400	500	400	500	400
Yield, t / ha	3,3	3,2	3,6	3,8	3,5	3,6

First of all, this was due to the quality of tillage, the quality of preparation of the seedbed and, accordingly, sowing. There was also a problem with soil heterogeneity in the plough-treated varieties, which was greater than in the "minimal variants". The reason is that the arable horizon in the experimental field is not uniform at a depth of 20-25 cm, and the removal of the infertile layer to the soil surface during plowing for many years gave this picture.

In 2011, the yield of spring barley on non-ploughed varieties treated with a cultivator by 15-17 cm was also higher by 0.3 t / ha of ploughed variants (Table 5). The yield of the "minimal" variants with a lower intensity of tillage to a depth of 8-10 cm gave the yield the same as the plowed variants. On the variants with dump treatment, the problem with the heterogeneity of the soil remains, and the main drawback of the "minimal" variants is noted-weeds. Based on this, it is concluded that when.

Table 5. Results of the experiment (2010 – 2011) Culture: Spring barley - "Sonnet", 2 reproduction. Seeding rate: 450 germinating grains per m2 (235 kg / ha). Predecessor: Winter wheat (harvested for grain 30.07. 2010.)

Technology	Plow 20-22 cm	Cultivator, 17-20 cm	Cultivator, 15-17 cm
Yield, t / ha	2,5	2,8	2,4

The refusal of the plow on the gray forest soils of the Vladimir region is possible, but the intensity of the main tillage should be high enough. The magnitude of soil treatment shall not be less than 15 – 17 cm Main processing of the soil under spring rape were carried out with some modifications.

The depth of processing on both "minimum" variants was increased by 5-10 cm. This was due to the results of the previous three years of the experiment. Minimal tillage to a depth of 8-10 cm showed a worse result compared to tillage at 15-17 cm. Therefore, it was decided to explore deeper tillage. How deep can the processing without turning the reservoir be and how it will affect the quality of sowing and yield. As can be seen from Table 6, the yield of spring rapeseed in the experimental field was quite high. The plow and the "mini-mall" version, processed at 17-20 cm, showed almost the same result of 2.48 and 2.46 t / ha. A variant without a plow processed for 15 – 17.

Table 6. Results of the experiment (2011-2012). Culture: Spring rapeseed – "Azorno" - Rapul, F1. Seeding rate: 2.8 kg / ha. Predecessor: Spring barley (harvested for grain on 25.07.2011.)

Technology	Plow 20-22 cm	Cultivator, 17-20 cm	Cultivator, 15-17 cm
Yield, t / ha	2,48	2,46	2,53

In 2010, studies of the agrophysical state of the arable horizon of 10-20-30 cm were carried out in the experimental field. From Table 7, it is established that the field moisture capacity of arable soil in the experimental field is normal. There were no fundamental differences in this indicator for different tillage options in 2010.

Table 7. Dependence of the field moisture capacity (%) on the measurement depth (cm) (norm, 35 %)

Variant	1			2			3		
Depth, cm	10	20	30	10	20	30	10	20	30
Humidity, %	39,7	39,5	40,7	38,8	39,3	38,0	40,5	54,6	39,0

With a soil density higher than 1.5 g / cm3, there is a possibility of problems with the penetration of plant roots into the depths, and, accordingly, this leads to a decrease in the yield of agricultural crops. The density of the soil, in the minimum variants, gradually increases as the depth of soil cultivation increases. The highest soil density was on the variants without a plow, at a depth of 30 cm (Table 8).

Table 8. Dependence of soil density (g / cm^3) on the depth of measurement (cm) (norm 15 g / cm^3)

Variant	1			2			3		
Depth, cm	10	20	30	10	20	30	10	20	30
Soil density, (g / cm3)	1,25	1,30	1,26	1,19	1,37	1,40	1,27	1,37	1,47

Despite this, the soil density index did not exceed the permissible limit.

The pore volume or porosity of the soil is the most important agrophysical characteristic, depending on the mechanical composition and moisture content of the soil. In natural conditions, especially in the humid, i.e. humid zone, which includes all areas covered with forests, soils always contain not only air, but also moisture in the pores. The amount of moisture that the soil can retain, and which plants and microorganisms use for a long time, is determined by the structure of the pore space, i.e., the ratio of pores of different sizes within the soil.

From the point of view of agrophysical and water-physical properties, the soil of optimal mechanical composition (light or medium loam) and optimal density (1.1 - 1.3 g/sm^3) should be considered "good". In such a soil, the porosity reaches 45-55 % with a satisfactory structure of the pore space and a high water retention capacity (Table 9).

Table 9. Dependence of the total pore volume (%) on the measurement depth (cm) (norm 38 %)

Variant	1			2			3		
Depth, cm	10	20	30	10	20	30	10	20	30
Total pore volume (%)	52,91	51,06	52,38	54,98	48,38	47,09	52,19	48,49	44,49

Soil air is a source of carbon dioxide for plants used in photosynthesis. From 38 to 72 % of the total amount of CO_2 used to build the crop comes to the plant from the soil. Non-capillary air capacity, i.e. the air capacity of interaggregate pores, cracks and chambers, is essential for ensuring normal soil aeration. It includes large pores, interstructural cavities, root and worm passages in the soil thickness and is mainly associated with free soil air. Non-capillary air capacity with the lowest moisture capacity, is of particular importance for aeration. If the air capacity at the lowest moisture capacity is less than 15 %, then the soil aeration is insufficient to ensure a favorable composition of soil air.

The amount of non-capillary air for all variants of the intensity of tillage has a fairly low indicator. First of all, there are options without a plow. A decrease in the volume of non-capillary air is observed with increasing depth (tab 10).

Table 10. Dependence of non-capillary air capacity (%) on the depth of the measurement (sm) (norm 15 %)

Variant	1			2			3		
Depth, sm	10	20	30	10	20	30	10	20	30
Non-capillary air capacity, (%)	13,21	11,56	11,68	16,18	9,08	9,09	11,69	6,00	5,49

Hardness is an important agricultural indicator that characterizes the physical and mechanical properties of soils, more precisely, the resistance of the soil to root growth, or the resistance of the soil that needs to be overcome by the tillage working body during its processing. When using dump plows, a "plow sole" is formed, which prevents the penetration of moisture from precipitation into the lower layers. This, in turn, contributes to the development of water erosion on the slope lands, and on the plains and in the lowlands - the formation of wet "saucers" in which melt and rainwater stagnate. The resistance of 1.5 MPa can be considered as the upper edge of the normal growth of the root system of plants. This pressure is provided by the root system of many types of agricultural plants (Fig. 3).

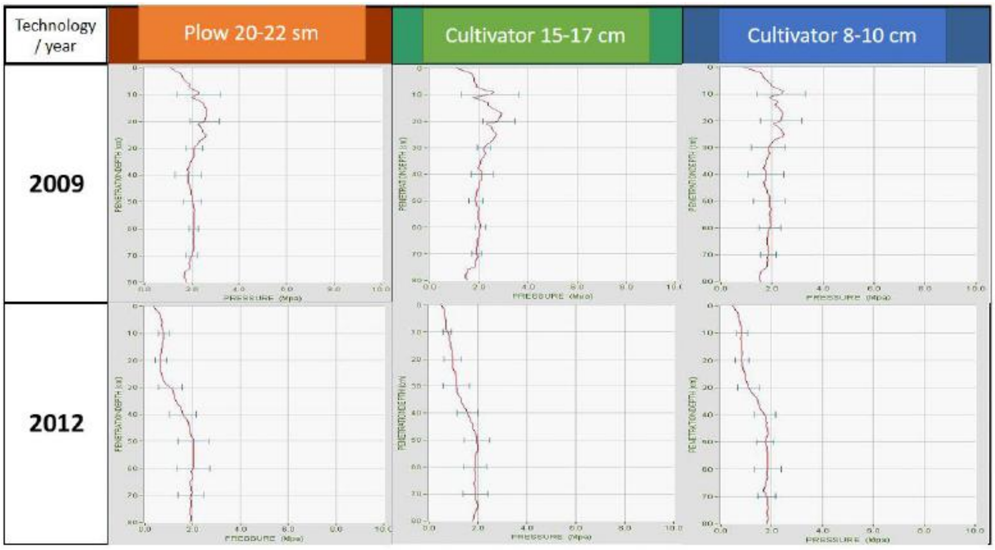

Figure 3-Resistance (hardness) soils (MPa)

In order to improve the quality of sowing grain crops with pneumatic seeders, a new design of a coulter for strip sowing has been developed (Patent 124526) (Fig. 4).

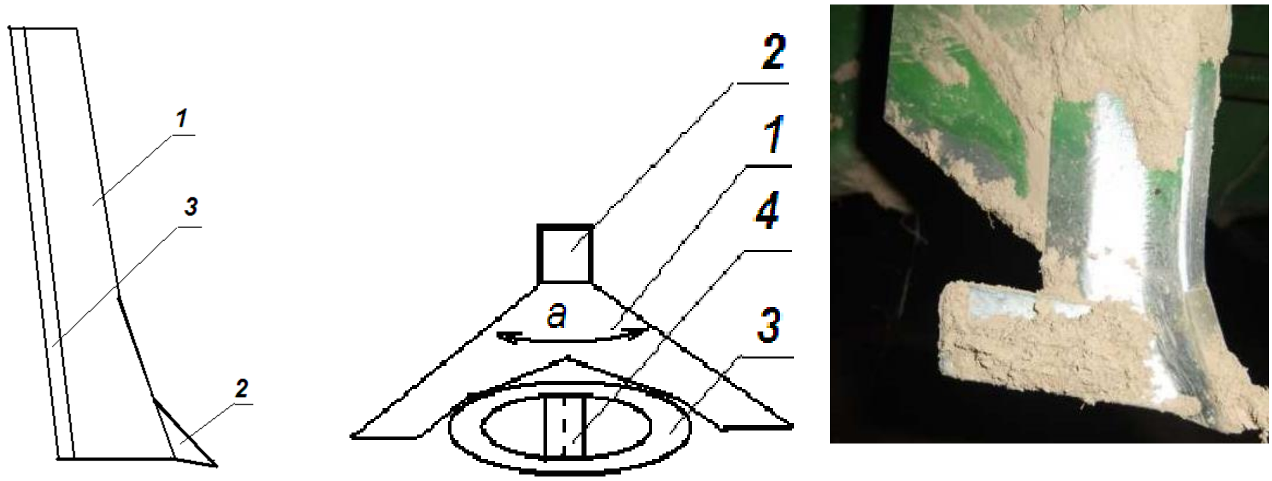

Figure 4-Coulter for strip seeding (Patent 124526) [9-10] 1-stand; 2-sock-naralnik; 3-vas deferens, 4-partition-distributor

When driving planter opener with stand 1, attached to the lower part of the Shoe having a wedge-shaped Breasts and toe-maralnik 2, and on the rear surface of the VAS deferens 3, with the drive mechanism seeders deepens in the ground and has to move forward, opening Bo-Rosu. When working planter seed material supplied sowing APPA-Rath, the VAS deferens into the lower elliptical part, where the flow is divided by the vertex of a triangular partition-way valve 4 into two equal parts, which are directed on opposite sides of a triangular partitions-rail. Due to the fact that the ellipse is oriented with its large axis across the axis of movement of the coulter, most of the seeds are sown on the left and right sides, and a small proportion of seeds fall into the nose part, due to the shading of the seed distributor. Thus, the entire flow of seeds is distributed at the bottom of the furrow into two rows, ensuring the absence of seeds in the problematic, from the point of view of embedding, area under.

Seeds at the bottom of the furrow are covered with soil with a special zagartach or disks installed behind the coulter [9,10,11,12,13,14].

Wedge-shaped rack and Shoe opener, and the presence of ellip-conformable of the VAS deferens with a triangular partition allocator, POS-vasut to improve the quality loosening of the soil, the uniformity of distribution and seeding, and, consequently, their germination, reduce energy costs when sowing, due to the wedging action opener for SMOS-Woo, and reduce the deterioration of structural elements of the Shoe, due to the reduction of the contact angle of the surface of the vomer with the soil.

The design of the coulter (Patent 124526) for combined strip sowing units was awarded a diploma and a bronze medal for participation in the competition "For the production of highly efficient agricultural technology and the introduction of advanced resource-saving technologies", in the nomination "Tillage and Sowing machines" at the 16th Russian Agro-Industrial exhibition "Golden Autumn-2014" (VDNH, 2014y).

Conclusions. 1. As a result of the research, it was found that the main problem associated with the physical condition of the soil at the experimental field in JSC "Lednevo" in the Yuriev-Polsky district of the Vladimir region was a significant compaction of the soil at a depth of 20 – 25 cm. When using the dump treatment, increased soil heterogeneity was observed, and in the "minimal" variants, the presence of weeds was noted, which required a change in the strategy of using plant protection products and strict compliance with crop rotation.

2. Based on the conducted research in the Vladimir Opolya region, in order to remove the plow sole and reduce soil compaction, deep loosening of the soil to a depth of 35-40 cm is recommended in autumn, followed by a transition to minimal tillage by cultivators to a depth of 15-17 cm with strip sowing of grain with pneumatic seeders, which increases the yield of winter wheat, spring barley and spring rapeseed by 0.3 – 0.45 t / ha. At the same time, there is a decrease in economic costs by 261-290 r/ha when using non-dump treatment.

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AGRICULTURAL ENGINEERING SOLUTIONS

ISSN: 2181-399X Volume 1, Issue 1, 2023

SUBSTANTIATION THE MATERIALS AND METHODS OF TECHNICAL SERVICE AND REPAIRING OF AGRICULTURAL MACHINES

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Annotation. This scientific article provides substantiation of the rational structure of the repair and maintenance base of agricultural machinery, methods for determining the needs for material and technical means, taking into account the appropriate proportions between the links of the repair network. The maintenance and restoration of the operability of tractors and other agricultural machines in sufficient limits is ensured, as is known, with the help of a system of maintenance and repair, which provides for the implementation of preventive maintenance operations and the conduct of routine and major repairs of machines in a planned manner. The established system of maintenance and repair, the creation of a material and technical base for its implementation, as well as a continuous process of improving the qualifications of machine operators and repair personnel contribute to the effective use of equipment in agriculture. At the same time, there are significant disadvantages in the use of tractors and agricultural machines. The analysis of the results of numerous studies of VIMa, ChIMESXa and other organizations made it possible to identify and systematize the loss of time due to machine downtime. In particular, machine downtime for regulated maintenance is 10-15% of the shift time, for technical malfunctions - from 5-8% for plowing, up to 30% for harvesting crops. The volume of work on the repair of cars in the country as a whole is more than 2 times higher than the standard. The efficiency of maintenance and repair of machines largely depends on the level of the material and technical base of these works - the availability of modern equipment and tooling, industrial buildings, warehouse and other structures, inventories, means of transport and communications.

Key words: productive capacity, maintenance, repairing and service bases, enterprises

Introduction. Modern views on the system and methods of organizing maintenance and repair of machines is based on long and numerous studies. The scientific foundations and the general theory of loss and restoration of the working capacity of tractors and agricultural machines were developed in the works of V.I. Kazartsev, A.I. Selivanov, I.S. Levitsky, I.E. Ulman, M.M. Severiev, D.G. Vadnvasov, and on cars - in the works of V. V. Efremov, K. G. Koshkin, L; V. Dekhterinsky, V. D. Shadrichev, T. II. Sharonova and others. The study of published works, analysis of the shortcomings of the existing system, generalization of advanced domestic and foreign experience made it possible to define in a new way the ways and main directions of improving maintenance and repair.

To study the patterns of changes in the main technical and economic indicators of the use of machines, the data of the Tselinny branch of GOSNITI, obtained as a result of eight years of monitoring the work of a large group of tracked tractors of the 3t class, were analyzed. These data indicate a constant decrease in their post-repair resource as the operating time increases and the number of bulkheads increases. Despite the increase in the number of repairs, the average shift operating time of these tractors by their average service life (4 years) decreases by 10% in comparison with the operating time in the first years of operation. The number of shifts worked by tractors after 4 years is reduced by 20%, the annual operating time - by 27% [1, 2, 3, 4]. By the amortization service life of tractors (8 years) such indicators change and the side of deterioration is almost twofold. The consumption of spare parts by the average service life of tractors increases 2-3 times for transmission parts, 4-5 times for road wheels, and 8-10 times for cylinder-piston group parts.

Along with a decrease in the productivity of tractors, it was noted that the consumption of funds and the labor intensity of repair work on tractors change linearly as they age, increasing at the end of the depreciation period by about 2.5 times compared with the indicators of the second year of operation [5]. Similar indicators were noted when observing the operation of combine harvesters and other machines. Consequently, the applied system and methods of maintenance and repair of machines, the performed repair actions do not ensure the maintenance and restoration of their normal performance. This happens in many cases because the existing system is based on a simple relationship between the operating time of machines and their need for repair effects. The system does not sufficiently reflect the structural and technological properties of various machines and the patterns of their wear, does not take into account the whole variety of conditions of their operation and the influence of random factors on the change in the state of machines [5, 6]. Such a system does not contain justified methods for determining the time points for performing the required maintenance and repair operations, which is one of the sources of violation of the regulations and the content of repair actions [7, 8, 9]. The production conditions of maintenance and repair also often do not correspond to the actual needs of the machines.

Thus, the improvement of the existing system and methods of maintenance and repair of machines is an important national economic problem. This became especially evident in connection with the broad statement in the research of a more modern - the probabilistic approach in the study of the phenomena of wear and identification of the needs of machines for repair effects.

Materials and methods. The object of the study was certain constructive and technological properties of machines, wear characteristics and indicators of the durability of their elements, and mainly the DT-75 and MTZ-50 tractors, which are the most complex in a constructive sense, in connection with which their proper organization maintenance and repair presents the greatest difficulties [10].

In accordance with the set goal and the main content of the study, its specific tasks are determined:

- to substantiate methods for improving the management of the operability of machines, to develop the main directions of organizing actions to improve their maintenance and repair.
- to investigate the main causes and nature of wear of machine elements, to determine the structure of repair and maintenance work and ways to restore their performance.
- to determine the methodology for the development of the main repair standards characterizing the modes of partial reimbursement of the machine's suitability: the frequency and structure of the repair cycle, the assessment of the complexity of the repair, etc.
- to substantiate the most rational methods of organizing maintenance of machines as probabilistic systems that provide partial compensation for their suitability.
- to determine the expedient structure of the repair and maintenance base of agriculture, to develop methods of material and technical support for the maintenance and repair of machines.

- to substantiate the control system of the reliability of machines: methods of control, methods of standardization and control of reliability.

The multifaceted nature of the work predetermined the variety of methods for studying particular issues, at the same time they are based on some general principles that allow finding a unified approach and establishing the relationship between various aspects of the problem.

$$y = 4019 - 953x + 72x^2 \tag{1}$$

where, x - the number of repairs.

Establishing the pattern of reducing the MTBF made it possible to formulate a hypothesis about the occurrence in the mechanisms of machines with an increase in the duration of operation and as a result of bulkheads during the repair of unfavorable operating conditions of parts that affect their durability.

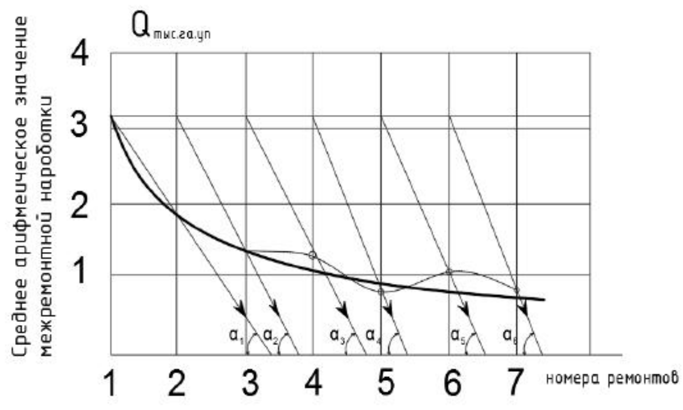

Figure 1. Change in the MTBF of the gearbox of 3t class tractors. depending on from the number of repairs.

Taking into account that the basis of the repair and maintenance base is made up of equipment and tooling, classified by us in terms of cost, productivity and complexity of work, the following conclusions were drawn:

- the operations of successive reimbursement of the suitability of machines with an indicator of C_{mex} <1.7, which do not require complex and expensive equipment, are carried out directly on the farms (detailed);

- operations of successive reimbursement of the suitability of machines with an index of C_{mex}> 1.7, performed with the help of expensive and high-performance equipment, are subject to a certain centralization within economically justified limits;

- the processes of one-time reimbursement of the suitability of machines and assemblies, the restoration of parts, requiring a high level of production equipment, must be carried out centrally at special enterprises. Thus, the repair base seems to consist of three main structural links: the repair and maintenance base of the economy, the production and technical base of the district level and a network of specialized repair enterprises.

Optimal solutions for the centralization of service are made by minimizing the reduced costs, characterized by a decrease in the amortization of production assets and losses from downtime during service with an increase in the number of machines serviced in one place and an increase in the cost of transporting machines to places of service and losses from downtime during transportation, which is shown in Fig. 2.

The need for production capacities of various links of the repair and maintenance base was determined by analyzing the technological content of repair and maintenance work, a model of their distribution among the links of the repair network was created, a model need for repair and maintenance work was calculated to assess the availability of production capacities in comparison with the required ones. The model of the distribution of work on the maintenance of machines between the links of the repair network was obtained in two conditional versions:

- in the first - it is envisaged to perform all operations of periodic maintenance and more than two-thirds of the volume of work of current repairs by the forces of farms;

- in the second - complex maintenance of tractors (TO-3), cars (TO-2) and their current repairs by specialized repair services. Depending on local conditions, other options for the distribution of work may be accepted, however, they will all be within the intervals established by us.

According to the annual reports of the enterprise, labor costs for maintenance and repairs by types of machines and the resulting models of the distribution of work between the links of the repair network, the following distribution is determined, given in table. 1.

According to the most promising second variant of the distribution of work, in which, for example, in 70 farms in the Rostov region, the average annual unit costs of repair and maintenance of machines have a minimum value (0.76 rubles / ha c.p.), it was concluded that farms should

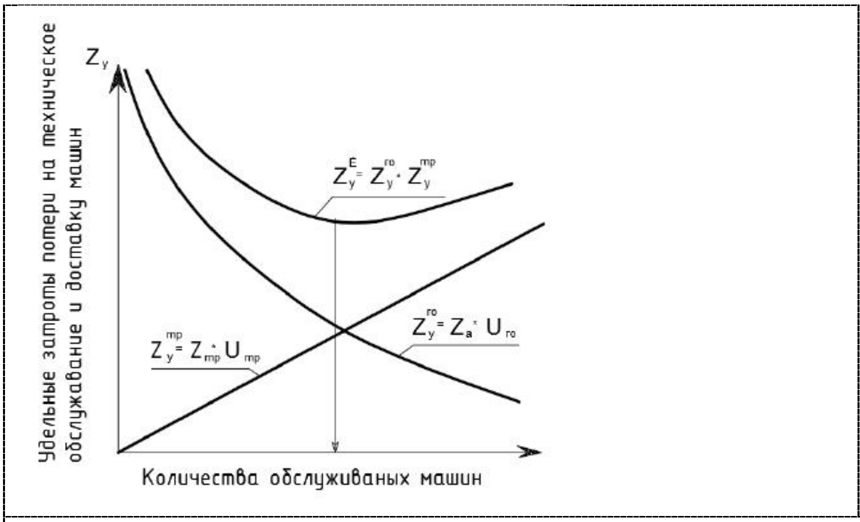

Figure 2. Dependence of the main variables of unit costs for maintenance on the number of serviced machines.

$Z_y^{то}$ - unit costs and losses in the maintenance of machines; Z_a is the amount of depreciation of production assets; U_{TO} - losses from downtime during machine maintenance; Z_y^{TO} - unit costs and losses for transportation of machines; Z_{mp} - the cost of transporting machines; U_{mp} - losses from downtime during transportation of machines; Z^{Σ}- total unit costs of losses for maintenance and delivery of machines.

Table 1. Job distribution options:

Variants distribution of work	General volume works	Performed in%		
		farms	my district link	Spetsializirovannymi predpriyatiyami
I - option	100,0	61,6	10,0	28,4
II- option	100,0	46,4	22,2	31,4

to carry out simple operations in terms of the labor intensity of about half of the total volume of repair and maintenance work. The share of specialized enterprises is about 30%. and district services -20%

of the volume of work, and the most complex. It means that the district services should specialize in performing complex periodic maintenance and current repairs of machines.

Calculations show that the capacity of specialized enterprises to carry out work on the repair of units and machines currently reaches only 48% of the required capacity, maintenance points - about 25%, mobile repair shops - 38%. mobile maintenance vehicles - 56%. The basis of the material base of the service is made up of stationary facilities, in combination with which mobile ones operate, reducing the downtime of machines. The paper gives a schematic diagram of the interaction of maintenance and repair facilities.

The calculation of the need for service facilities is carried out using the accepted methods in terms of their performance and duration of service. The total duration of service $\Pi_{\text{С}}^{0}$ is determined by the expression:

$$\Pi_{\text{С}}^{0} = \sum_{i=1}^{n} \cdot \sum_{j=1}^{m} \cdot \Pi_{ij}^{o} \cdot k_{ij} \tag{2}$$

where Π_{ij}^{O} - duration of one service (repair), h:

k_{ij} - the number of serviced cars; n and m - the number of services and their types.

The tenological fund of the time of operation of the means of maintenance and repair Φ_m is equal to the difference between the operating fund of time Φ_p and the time of downtime of the means of service in the repair $\text{Т}_{\text{РЕМ}}$ as well as the time spent on moving $\text{Т}_{\text{ПЕР}}$.

$$\Phi_m - \Phi_p - (\text{Т}_{\text{РЕМ}} + \text{Т}_{\text{ПЕР}}). \tag{3}$$

The need for one or another type of service facilities $\text{Р}_{\text{СР}}$ is divided by the ratio of the operational duration of service Π^{0} to the technological annual fund of time from the expression:

$$\text{Р}_{\text{СР}} = \frac{\Pi^{0}}{\Phi_{\text{Т}} \cdot \text{К}_{\text{В}}} \tag{4}$$

where K_B - coefficient taking into account intra-shift loss of time,

K_B = 0,85 - 0,95.

The effectiveness of the use of one or another set of maintenance and repair tools is determined by the well-known methods of minimizing losses $U_{\text{тор}}$ from a decrease in the productivity of machines and, therefore, a shortage of products or a decrease in prices with a deterioration in its quality, the reduced costs of maintenance and repair tools and wages for repair workers: [19, 20].

$$U_{\text{ТОР}} = S \sum_{k=1}^{m} \cdot C_k \, \text{У}_k \, \text{Р}_k + \sum_{i=1}^{n} \cdot \text{Б}_i \, \text{Е}_i \, n_i^! \, \frac{\text{Т}_{ik}^{!}}{\text{Т}_{ik}^{i} + \sum_{j=1}^{p} T_{ij}} + \sum_{i=1}^{q} T_{tk}^{!} \, \text{К}_{3i} \rightarrow min \tag{5}$$

Where S - the area on which the serviced machines operate, hectares;

С_k - cost of 1 centner of the k-th product, rubles;

У_k- yield of the k-th product, c / ha;

Р_k - the coefficient of yield losses of the k-th product from downtime and reduction of the chain from deterioration in quality;

Б_i - the book value of the i-th means of maintenance and repair, rubles;

E_i - standard coefficient of efficiency of capital investments;

n_i - the number of funds of the same name;

T_{ik} - the time spent by the i-th maintenance and repair facilities for the production of the ki-th product, h;

T_{ij} - the time spent by the i-th maintenance and repair facilities on other j-th work performed during the hearth, h;

K_{3i} - the cost of an hour of work of workers during maintenance and repair, rubles.

Modern machines have a large number of series-connected parts, which inevitably degrades their reliability indicators. Therefore, in order to improve the reliability indicators based on the works of D. Neumann, it is concluded that it is necessary to create an unloaded reserve of spare parts for machines, which are concentrated, depending on their cost and scarcity, directly on machines, on mobile or stationary service facilities, or in regional and regional technical exchange points. At the same time, the reduced losses of farms from failures should be greater than the cost of the reserve elements, therefore the total present value of the unloaded reserve is controlled on the basis of the following criterion:

$$\sum_{i=1}^{n} G_i^P \leq U_t \cdot \sum_{i=1}^{n} \Delta_i \cdot P \qquad (6)$$

Where G_i^p - cost of reserve i-elements, rubles;

U_t - losses of farms from machine failures, rubles;

$\Delta_i P$ - the magnitude of the increase in the reliability of the i-th element.

Findings. The calculation results show the expediency of the direction of development of production and technical bases for high-quality maintenance and repairs of agricultural machines. The costs of labor and funds for the maintenance and repair of machines for the amortization period significantly exceed the same costs for their manufacture. For tractors, for example, these pile costs are 6-10 times higher than the labor costs for manufacturing and, accordingly, the cost of money is 3-6 times.

Increasing the efficiency of using a particular set of maintenance and repair tools is determined by the known methods of minimizing Uter losses from a decrease in the productivity of machines and, therefore, a shortage of products or a decrease in prices with a deterioration in its quality.

The need has ripened to attract investments in the field of reconstruction and construction of new production and technical bases with more modern equipment and tools that meet the requirements of machines produced for agriculture.

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