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# A TECHNIQUE FOR DIGGING POTATOES PLANTED IN SMALL AREAS

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***Abstract.*** *The scientific article discusses the justification of the parameters of the techniques for digging potatoes planted in small areas. The results of field research and theoretical justification of the parameters of the improved potato digger are shown*

***Keywords:*** *Improved potato digger, rod, potato, digger, lattice plowshare, torque, vibration.*

## 1. Introduction

In the world, scientific and research work is being carried out aimed at improving energy and resource-efficient methods of digging potatoes and the weapons that implement them. In particular, special attention is being paid to the creation of energy and resource-saving tools, which can perform high-quality and complete digging of potatoes in small areas. In this regard, it is considered urgent to improve potato digging methods, develop forced vibrating potato diggers that implement them, justify their technological work process and parameters of working parts.

In the agricultural production of our republic, comprehensive measures are being taken to reduce labor and energy consumption, save resources, harvest products based on advanced technologies, and develop high-performance agricultural machines, and certain results are being achieved. In the strategy of agricultural development of the Republic of Uzbekistan for 2020-2030, among other things, "...private investment to support the modernization, diversification and sustainable growth of the agricultural and food industry The tasks of reducing state participation and introducing mechanisms for increasing investment attractiveness, rational use of land and water resources, increasing productivity in farms, improving product quality. In the performance of these tasks, it is important to carry out research in areas such as the development of a potato digger equipped with grating plowshares and oscillating plows that ensure high productivity due to low energy consumption in the process of digging potatoes, and the justification of the parameters of the working parts that ensure high work quality. is doing.

Creation of potato digger machines abroad, improvement of constructions of digging bodies and justification of their parameters. Halderson, A. Sptcht, P. Howard,

J. Breska, G. Knochel, A.A. Sorokin, G.D. Petrov, V.A. Sakun, Y.P. Lobachevsky, A.M. Marchenko, M.Ye. Matsepuro, S.N. Borichev, E.S. Reingart, W.T. Amilechev, N.Y. Lipsky, I.R. Razmislovich, M.B. Uglanov, N.F. Studies by Didenko et al.

## 2. Materials and methods

The purpose of the study is to justify the parameters of the potato digger, which will increase the productivity and provide high quality indicators.

The physico-mechanical properties of potato-planted field soil, a grid harrow and a vibrating potato digger were taken as the object of the study.

The subject of the research is potato digging technological process, the processes of interaction of the improved potato digger's grating blade and oscillating blade with lumpy soil and their parameters, the laws of change of the digger's energy and quality indicators. Research methods. In the process of research, the rules of mathematical calculation, laws of theoretical mechanics, methods of statistical analysis, determination of the degree of loss and damage of potatoes with the potato digger's working bodies, mathematical planning of experiments and tensometry methods, as well as the methods specified in the existing regulatory documents, were used.

The practical results of the research are as follows:

an improved potato digger with a grid plow and a oscillating hoe was developed;

when the developed improved potato digger is used, minimal loss and damage of potatoes and reduction of energy-resource consumption have been achieved. Scientific and practical significance of research results. The scientific significance of the research results is explained by the fact that the design of the improved potato digger with a grating and oscillating grater has been developed, and the results obtained in theoretical and practical studies can be used to justify the parameters of other similar machines and working bodies.

The practical significance of the research results is explained by the fact that with the developed improved potato digger, an increase in fuel and lubricants, labor consumption and productivity was achieved due to digging potatoes at the level of agrotechnical requirements, using less energy.

During the operation of the potato digger, the soil and lumps from the plow interact with the rods, and the quality and reliability of the technological process mainly depends on its character and time. In the process of work, the nodular soil crushed under the influence of the harrow moves along its surface and falls into vibrating piles, and under their influence, the nodular mass is further crushed and the potato is separated from the soil. The crushed soil passes through the sieves, that is, the soil is sieved. Potatoes left in the rods move to their ends and fall to the surface of the field.

The time of sliding of potatoes on khivych depends on the physical and mechanical properties of potatoes and the parameters and mode of operation of vibrating khivych. The time of sliding of potatoes on the sieves should be minimal, on the contrary, accumulation of unsifted soil and lumps occurs, which leads to clogging of the potato digger and increases its traction resistance. According to Rod, we determine the time of sliding of soil and potatoes according to the following expression.

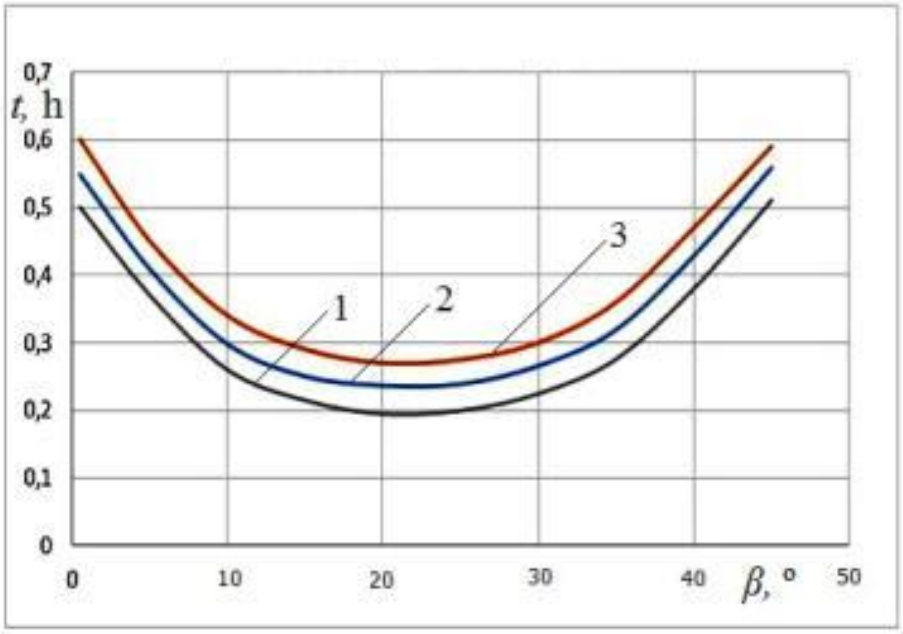


**Figure 1. The dependence of the time t for the soil to fall from the rod on the angle of its installation bx**

As can be seen from Figure 1, for a 25-cm-long rod, when the angle of its installation relative to the horizon (bx) is in the range of 16º to 30º, the time of sliding potatoes along the rod has a minimum value 0.27-0.3 sec. will be between

## 3. Results and discussion

Based on the above, it is desirable if the average value of the installation angle of the khivich with respect to the horizon and its extreme values are between 16º and 30º. In this case, there is no accumulation of tubers in the pile, and the resistance of the potato digger to the pull is minimal.

## 4. Conclusions

To base the design of the potato digger, diggers of four types were made: with a working body of the "paraplau" type, equipped with khivych; in the form of a claw equipped with khivichs; non-oscillating grid plows and oscillating grid plows.

According to the results of experimental studies, it is advisable to equip the potato digger with a grid plow and vibrating hivets to ensure the loss and damage of potatoes at the required level. The conducted analyzes made it possible to develop the

design of an improved potato digger, which increases productivity, ensures minimal damage and loss of potatoes, based on the structural features of the existing weapons used in potato digging and their working parts.

The most optimal design of the improved potato digger is a design consisting of a transmission mechanism, a grid plow and forced oscillating coulters.

As a result of the conducted theoretical research, analytical links and mathematical models were obtained that allow determining the parameters and operating mode of the improved potato digger griddle and oscillating plows.

Rapid splitting of the knotted sedge at the required level with low energy consumption. The width of the plow with a grid should be 55 cm, the angle of installation of the plow with respect to the horizon should be 22º, the length of the plow should be 38 cm, and the distance between the slots of the grid should be 3 cm.

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# BIOCHEMICAL CHARACTERISTICS OF XYLANASE-PRODUCING BACILLUS SPECIES BELONGING TO THE GENUS BACILLUS.

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***Abstract:*** *Microbial enzymatic agents represent a primary enzymatic process, although their production may pose environmental risks, requiring extraordinary catalysts to mitigate these effects. This new study aims to scrutinize xylanase yields from Bacillus strains and identify key factors influencing this enzymatic synthesis. Bacterial isolates were isolated from plants.*

The current study aims to isolate and optimize process parameters for xylanase overproduction through synergistic phenomena. Bacillus halotolerans, Bacillus safensis, Bacillus pumilus belonging to the genus Bacillus showed the highest xylanolytic potential. Although five different media were evaluated for xylanase production, our findings differed significantly from previous experiments. Recently, special attention has been paid to the ability of microorganisms to produce thermostable enzymes (eg, proteases, lipases, cellulases, xylanases, and DNA polymerases) that can be active even under extreme conditions [1]. Therefore, these enzymes can be used in high-temperature industrial fermenters, which accelerate biochemical reactions, reduce the level of contamination and facilitate product recovery. In addition, thermophilic bacteria have other biotechnological applications, including the production of bioactive compounds (eg, exopolysaccharides, antibiotics, and biosurfactants). In addition, they can be used for the removal of heavy metals by bioremediation, as well as for the biodegradation of plastic polymers [2]. Microbial xylanases (1,4-β-D-xylan xylanohydrolase, are preferred catalysts for xylan hydrolysis due to their high specificity, mild reaction conditions, negligible substrate loss, and byproduct formation. However, the cost of enzymatic hydrolysis of biomass is one of the factors limiting the economic feasibility of the process. Therefore, it is necessary to improve the production of xylanases by finding more potentt fungal or bacterial strains, or by developing mutant strains that secrete more enzymes, or both. Xylanases are produced by many organisms such as bacteria, algae, and fungi. Most of the bacteria

and fungi secrete extracellular xylanases which act on the hemicellulosic material to liberate xylose as a directly assimilable end product allowing the organisms to grow heterotrophically on xylan. Aspergillus, Penicillium, Bacillus, Trichoderma, Clostridium, Streptomyces, Penicillium and Fusarium species, Trichoderma sp., Aspergillus sp. A number of microorganisms known to produce xylanase, such as Bacillus species, are generally preferred for enzyme production because they are easy to isolate and identify, grow rapidly, have a short fermentation time, and absorb enzymes directly. environmentally friendly and low cleaning costs. Because of these advantages, Bacillus species have come to the fore in research on xylanase production, and they are safe and can be used in a variety of food processes and only some belong to the genus Bacillus.

## METHODS

### Isolation of bacteria from plants

The collected plant samples were homogenized and 1 ml of sterile PBS buffer (137 mM NaCl, 2.7 mM KCl, 1 mM Na2HPO4 and 1.8 mM KH2PO4; pH 7.4) was added and mixed. The solution was serially diluted to 10-6 with sterile buffer. Each diluted sample was placed on nutrient agar (NA) in a laminar flow cabinet (0.5% peptone, 0.3% beef extract, 1.5% agar, pH 6.8). The plates were placed in a thermostatic bacterial incubator. placed at 28 degrees Celsius for 48-96 hours until colonies appeared. The morphology of bacterial colonies differs from each other in their shape, size, border and height

### Enzyme activity assay

Liquid enzyme activity was measured from relevant substrates, such as xylanase. Antagonists were produced from among the tested bacterial samples. Separated bacteria were cultured 3 times for each enzyme with substances harmful to bacteria.4-nitrophenyl beta-D-xylopyranoside 27.1 mg of dry mass was taken and each enzyme was dissolved in 10 ml of PBS buffer. This analysis process takes the active fractions in a microtitre with a total volume of 200 l for qualitative quality. Activity reactions to the above enzymes were evaluated by the development of bacterial colony color (yellow).

## RESULTS

Bacterial strains showing antagonistic properties were isolated from among the tested bacterial samples. Nutrient agar was selected as the optimal medium for growing bacterial samples.Antagonistic bacteria were carefully transplanted into 30 petri dishes. Each bacterial sample was transferred to 3 nutrient mediums in the same way for 3

different enzymes. 4-Nitrophenyl β-D-chloropyranoside enzymes were taken in the amount of 10 mM and dissolved in PBS buffer.4-Nitrophenyl β-D-chloropyranoside - 27,122 mg. Enzymes were released by acting on separately cultivated bacteria in the amount of 0.3 µM. Bacterial strains were left in the thermostat for 8 hours.As a result, the enzyme activity of our isolated isolates was determined by the change in the color of the colony.Antagonist bacteria take the leading place among bacteria in terms of enzyme activity.

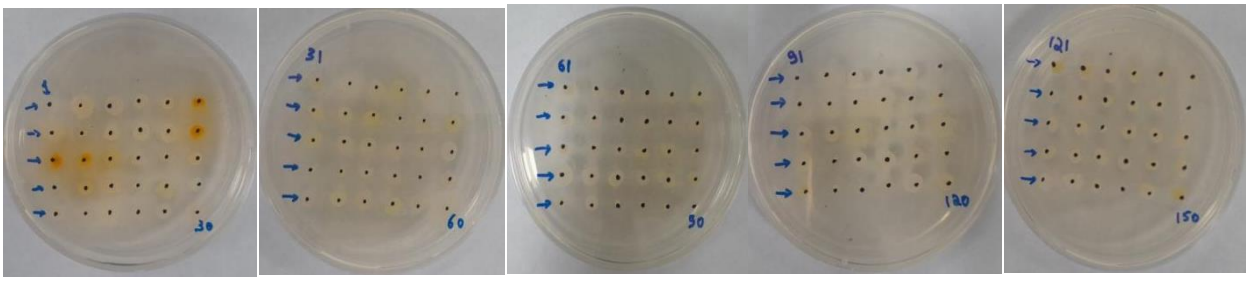


Fig. 1. Colony color change of bacteria tested for xylanase enzyme

The colony color of 16 species of Bacillus species belonging to the Bacillus family was determined by the change of color. Representatives of the Bacillus genus showed different levels of enzyme activity.Among the tested bacteria, 2 - Bacillus atrophaeus and Bacillus mycoides did not show sensitivity to enzyme activity. Bacillus stercoris and Bacillus inaquosorum bacterial species showed higher sensitivity than other species.

table 1

| **Sample** | **Xlyosidase Activity** | **Sample** | **Xlyosidase Activity** |
|---|---|---|---|
| Bacillus altitudinis | + | Bacillus mycoides | - |
| Bacillus amyloliquefaciens | + | Bacillus pumilus | + |
| Bacillus atrophaeus | - | Bacillus safensis | + |
| Bacillus cereus | + | Bacillus stercoris | ++ |
| Bacillus halotolerans | + | Bacillus subtilis | + |
| Bacillus haynesii | + | Bacillus tequilensis | + |
| Bacillus inaquosorum | ++ | Bacillus toyonensis | + |
| Bacillus mojavensis | + | Bacillus wiedmannii | + |

+++: Strong activity, ++: moderate activity, +: mild activity, −: no activity,

In these studies, the effects of xylanase production parameters such as pH of the initial medium, inoculation ratio, age of the inoculum, incubation temperature, incubation duration, composition of the medium, type of carbon and nitrogen source, agitation speed and aeration ratio were investigated. This indicates that there are various variables for the fermentation process, especially the species of xylanase-producing microorganisms. Since there are many parameters that affect the process conditions, it is complicated and time-consuming to determine the crucial parameters individually. Therefore, the process parameters that play a role in experimental studies must be determined practically. In addition, the optimization of the process conditions is important for both the yield and the economic efficiency of the process.

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# IMPROVING THE TECHNICAL WATER SUPPLY SYSTEM OF HYDROELECTRIC POWER PLANTS: MAIN RECOMMENDATIONS FOR INCREASING EFFICIENCY

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***Abstract:*** *Hydroelectric power plants (HPPs) play a crucial role in meeting global energy demands by utilizing water power for sustainable electricity generation. The technical water supply system is central to the efficient operation of these stations, ensuring a reliable and uninterrupted supply of water necessary for electricity production. However, with the aging of hydroelectric infrastructure and changing environmental conditions, there is a pressing need for continuous improvement and optimization of these systems. This article presents recommendations aimed at enhancing the technical water supply system of hydroelectric power plants, focusing on key areas for improvement and implementation strategies.*

***Key words:*** *technical water supply system of HPP, advanced turbine designs, hydroelectric power station, remote sensing, improvement.*

**Introduction**: In the past 5-7 years, President Sh. Mirziyoyev has enacted several decrees and decisions to develop the hydroelectric energy sector, including the construction and reconstruction of hydroelectric power stations, the advancement of renewable electricity generation, and the introduction of modern technologies. Since its establishment in 2017, 12 new HPPs have been built, and 9 more have been modernized. As a result, an additional 244 MW of electricity capacity has been created, and the number of small non-dam hydro plants is increasing, with a special focus on constructing small non-dam hydro plants. According to presidential decrees, compact hydropower stations with capacities of up to 500 kW are being installed on rivers and canals such as the Norin, Sokh, Tankhoz, Aq Bulak, and Ugam. These stations are also

being established in technical, irrigation, and architectural higher educational institutions to train qualified specialists for hydro facility operations.

It has been noted that special attention is necessary to establish construction and hydraulic laboratories in these institutions. The Decree of the President of the Republic of Uzbekistan PF-60 dated January 28, 2022, outlines the "New Development Strategy of Uzbekistan" for the period of 2022-2026. The 24th goal emphasizes the importance of ensuring an uninterrupted supply of electricity to the economy and actively introducing "green economy" technologies across all sectors. By 2026, the strategy aims to increase energy efficiency by 20%, with a target to boost electricity production by an additional 30 billion kWh, reaching a total of 100 billion kWh. Plans include achieving a 25% share of renewable energy sources by 2026, which is expected to save about 3 billion cubic meters of natural gas annually.

**Relevance**: Hydropower plants play a crucial role in the global energy mix by providing clean and renewable electricity. However, optimizing technical water supply systems is vital to maximizing their production potential and minimizing environmental impact. This article addresses the challenges faced by hydropower plants in managing water supply systems and offers recommendations for improvement. The aim is to provide valuable insights to help address these challenges, test solutions in practice, preserve soil moisture, and achieve sustainable crop yields through efficient water use.

**Purpose**: To improve the technical water supply system of hydroelectric power stations by developing key recommendations for increasing efficiency.

**Tasks:**

Recommendations for improving technical water supply systems:

1. Improvement of hydrological data monitoring:
   - Implement advanced monitoring systems for accurate water flow forecasting.
   - Use real-time data to optimize water release schedules.
2. Renovation of water transfer infrastructure:
   - Invest in modern piping and duct systems to improve water transport efficiency.
   - Implement remote sensing technologies for leak detection and infrastructure maintenance.
3. Implementation of water-saving measures:
   - Adopt water treatment and reuse practices at the power plant.
   - Promote the use of water-saving turbines and equipment to reduce water consumption.
4. Strengthening compliance with environmental requirements:

- Ensure strict adherence to environmental regulations regarding water quality and ecosystem protection.
- Implement eco-friendly practices to minimize the station's ecological footprint.

**Methodology:**

Understanding technical water supply systems: The technical water supply system of a hydropower plant includes various components and processes related to water resource management for power generation. These include water intake structures, penstocks, turbines, cooling systems, discharge channels, and more. The efficiency and reliability of these systems are critical to maximizing capacity and minimizing operational interruptions.

Aging infrastructure: Many hydropower plants around the world are operating with aging infrastructure, leading to increased maintenance needs and susceptibility to failures. Renovating and upgrading key components of the water supply system, such as water intakes and pipes, can enhance reliability and efficiency.

Resilience and reliability: Strengthening the resilience and reliability of technical water supply systems is essential to minimize disruptions and interruptions in energy production. This can include planning redundancies, establishing emergency response protocols, and adopting sound maintenance practices to prevent unexpected events and reduce operational risks.

**Comprehensive Assessment**: A thorough evaluation of the existing water supply infrastructure, identifying areas for improvement and potential weaknesses.

Stakeholder Engagement: Collaborate with key stakeholders, including plant operators, engineers, environmental experts, and regulatory authorities, to gather insights into system performance and identify issues.

Technical Analysis: Use advanced modeling and simulation tools to assess water flow dynamics, hydraulic performance, and potential bottlenecks in the supply system.

Prioritize Upgrades: Rank upgrades and investments based on their potential impact on system reliability, efficiency, and cost-effectiveness.

Innovative Technology Integration: Explore the integration of cutting-edge technologies, such as remote sensing, predictive analytics, and automation, to enhance monitoring, control, and decision-making capabilities.

Long-term Planning: Develop a long-term strategic plan for the continuous improvement and optimization of the water supply system, taking into account future energy demand, regulatory requirements, and environmental changes.

**Implementation Strategies:**

- **Pilot Projects**: Conduct pilot projects to test and validate the proposed recommendations in real-world conditions before full-scale implementation.

- Capacity Building: Provide training and capacity-building programs for plant personnel to ensure the proper operation and maintenance of upgraded systems.

**Results:**

- Environmental Challenges: Changes in environmental conditions, such as fluctuating water levels, sediment accumulation, and climate change, create challenges in managing water supplies at hydroelectric facilities. Implementing adaptive management strategies and incorporating environmental monitoring technologies can help mitigate these issues and promote sustainable water use.
- Optimizing Efficiency: Enhancing the efficiency of water intake, conveyance, and turbine systems is crucial to maximize energy production and reduce energy losses. Upgrades in advanced turbine designs, optimization of flow control mechanisms, and the use of intelligent monitoring and control systems can improve overall system efficiency.
- Partnerships and Collaborations: Foster partnerships and collaborations with industry experts, research institutions, and technology providers to leverage expertise and resources for the implementation of improvements.
- Regulatory Support: Secure supportive regulatory frameworks and incentives to facilitate investments in water supply system upgrades and enhancements.

**Monitoring and Evaluation**: Establish robust mechanisms to monitor the implementation of recommendations and evaluate their effectiveness, while identifying areas for further improvement.

**Conclusion:** Improving the technical water supply systems of hydroelectric power stations is crucial for optimizing electricity production, enhancing durability, and ensuring stable operation in the face of evolving challenges. By developing and implementing targeted recommendations, stakeholders can increase the efficiency, reliability, and environmental sustainability of these critical infrastructure systems. This will contribute significantly to the global expansion of clean and renewable energy production. The optimization of technical water supply systems at hydroelectric plants is essential for sustainable energy production and environmental protection. By adopting the recommended strategies and embracing innovation, hydropower plants can improve performance and play a pivotal role in the green energy transition. This study can serve as a foundation for the development of a comprehensive article that provides practical recommendations.

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# INSON VA BOSHQA TIRIK ORGANIZMLARGA TA'BIATNING ICHKI VA TASHQI MAGNIT TA'SIRLARI

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***ANNOTATSIYA***

*Hozirgi kunda insoniyattashqi muhit, ekologiya va shu kabi ko'plab omillar ta'sirida qolmoqda. Bunda inson ruhiyati bilan birga uning tanasida ham o'zgarishlarni kuzatish mumkin.Ya'ni tanadagi mikroelementlar miqdorining o'zgarishi, buzilishi kabi holatlar insoniyatning jiddiy muammosidir. Bunday vaziyatda inson organzmida sodir bo'layotgan o'zgarishlar tirik organzmlarni funksiyasini unda mavjud oqimlarni va ta'sir kuchlarini o'rganishni taqazzo etmoqda.*

***Kalit so'zlar**: magnitosfera, oqim, kimyoviy elementlar.*

## KIRISH

Tabiat -odamning paydo bo'lgunicha ham, odam ishtiroki bilan ham mavjud borliq. Tabiat odamga, jamiyatga bog'liq bo'lmagan qonuniyatga bo'ysunadi. Odam tabiatning bir qismi va shu bilan birga u organzmi uchun yashashi, hayot kechirishi uchun kerak bo'lgan zarur moddalar, elementlarni tabiatdan oladi.

Shuningdek, yer atrofida ko'rinmas qobiq magnitosfera mavjud bo'lib, u sayyorani quyosh nurlaridan himoya qiladi. Ammo quyoshda chaqnashlar sodir bo'lganda quyoshdan yerga yo'nalgan oqim tezligi oshadi, bosim muvozanati o'zgaradi, Yer ustidagi magnitosfera siqilib, undagi oqimlar kuchayadi. Bu hodisa magnit bo'roni hisoblanadi. Natijada Quyosh magnit maydonidan zaryadlangan zarralar yer magnitosferasiga kirib, oqimlarni hosil qiladi va uning magnit maydonida o'zgarishlarga olib keladi.

## USULLAR

Tirik organzlarga ko‘proq tashqi ta’sirning ahamiyati kuchliroq. Quyoshdan keladigan zaryadlangan zarralar oqimi doimiy ravishda yer magnit maydonining (magnetosfera) tashqi, eng yuqori qismiga ta’sir qiladi. Biroq, oqimi har doim ham barqaror emas va o‘zgarishi mumkin. Uning buzilishlari koronal teshiklar va massa chiqindilarini keltirib chiqaradi. Ushbu hodisalar paytida bizga eng yaqin yulduz milliardlab tonna plazma chiqaradi. Bu bir vaqtning o‘zida minglab yadroviy bombalarni portlatishga o‘xshaydi. Agar oqim yer tomon yo‘naltirilgan bo‘lsa, zarralar unga etib borishi mumkin. Odatda bu ikki-uch kun davom etadi, ammo kuchli chiqindilar bilan plazma 18 soat ichida 150 million kilometr masofani bosib o‘tishga qodir.[1] Oqim sayyoramizga yetib borgach, u yer magnitosferasini siqib chiqaradigan zarba to‘lqinini keltirib chiqaradi. Ushbu oqim protonlarining atmosferamizning vodorod atomlari bilan to‘qnashuvi elektr tokini hosil qiladi. Asta-sekin, bo‘ronning pasayishi bilan magnitosfera normal holatga qaytadi va oqim parchalanadi. Ichki magnit ta’sir esa hayot uchun eng zarur va odam organizmida (ya’ni qonida) doimo mavjud bo‘lgan fermentlar, gormonlar, vitaminlar miqdori bilan bevosita bog‘liq. Bu elementlarning yetishmasligi odamning organizmi faoliyatining buzulishiga olib kelishi mumkin.Shuning uchun biz qonni elektrolit deb aytishimiz mumkin, ya’ni unda zaryadlangan zarralar-ionlar mavjud bo‘lgan suyuqlik. Ammo, boshqa tomondan, qon zaryadlangan zarralar-ionlarni tashish orqali doimiy harakatni amalga oshiradi. Ammo biz bilamizki, zaryadlangan zarrachalarning tartibli harakati elektr tokidir[2]. Shuning uchun ionlarning buzilgan harakati tirik organizmda mavjud bo‘lgan elektr tokining kichikmiqdori uchun javobgardir. Elektr tokining har qanday yo‘naltirilgan harakati ikkita majburiy jarayon bilan birga keladi – bu o‘tkazgichlarni isitish va magnit maydon, oqim bilan o‘tkazgich atrofida.

## NATIJALAR

Magnitning bunday tashqi ta’sirlari va organzm ichki ta’sirlari natijasida tirik organzlar turlicha hayot shakliga ega. Biz aynan mana shu ta’sirlar oqibatlarini his qilamiz. Odatda tashqi ta’sirlar o‘rtacha 6-7 soat davom etadi va 3 kunda o‘z xoliga qaytadi. Ammo insoniyat va barcha tirik organzmlarning o‘zida bo‘ladigan ichki magnit ta’sirlar doimiy organzmni yashash tarziga uzluksiz ta’sir ko‘rsatib turadi. Shunday qilib, tirik organizmlarda magnit maydon mavjud[3]. Magnit maydonning kattaligi qon oqimi kuchliroq bo‘lgan joyda yuqori bo‘ladi. Olimlar, shifokorlar yurak sohasidagi magnit maydon chiziqlarining qalinlashishini isbotladilar. Inson tanasidagi magnit tasirga ahamiyat beradigan bo‘lsak odatda magnitlik xususiyatiga ega bo‘lgan elementlar o‘zaro tasirlashadi (ferromagnit, paramagnit, diamagnit).Masalan inson tanasining arterial bosim yuqori bo‘lgan nuqtalariga ferromagnitlarning tortilishi.

1-rasmda zamonaviy tibbiyot nuqtai nazaridan odamning magnit maydoni qanday ko‘rinishi ko‘rsatilgan.

**MUHOKAMA**

Shunday qilib, biz tabiatning va undagi barcha tirik mavjudotlarning uzviy bog‘liqligi, tabiatning aql bovar qilmaydigan donoligi haqidagi haqiqatni yana bir bor tasdiqlaymiz. Bunday bilimlar talabalarimiz uchun zarurdir. Aynan shunday ma’lumotlar STEM ta’limining eng muhim namoyonidir, bu yerda fizika, kimyo va biologiya kabi barcha tabiiy fanlar alohida to‘planadi[4]. Biroq, insonning magnitlanishi kam o‘rganilgan hodisa bo‘lib, bu hodisa haqida hali ham yagona fikr yo‘q. Ba’zi adabiyotlarda bu hodisa magnit ereksiya[5] deb ataladi. Biz ushbu hodisaga fizika nuqtai nazaridan eng yaqin talqinni topishga harakat qildik.

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# AVTOMOBIL YO‘LLARI-XALQ XO‘JALIGINING MUHIM TARMOG‘I

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***Annotatsiya.*** *Ushbu maqolada Respublikada zamonaviy avtomobil yo‘llar tarmog‘ining rivojlantirishi va uning xalq xo‘jaligidagi orni, iqtisodiyotni rivojlantirishdagi ahamiyati haqidagi ma’lumotlar keltirilgan.*

***Kalit so‘zlar.*** *Transport, avtomobil yo‘llari, yo‘l-transport kompleksi, yo‘lovchi, yuk tashish transport kommunikatsiyasi, transport infratuzilmasi.*

**Kirish.** Ishlab chiqarish va ijtimoiy infratuzilmaning hal qiluvchi tarmog‘i bo‘lgan yo‘l-transport kompleksi iqtisodiy islohotlarni amalga oshirishda salmoqli ahamiyatga ega. Transport va transport kommunikatsiyalari O‘zbekiston Respublikasi xalq xo‘jaligi majmuasining (kompleksining) ajralmas tarkibiy qismi va ishlab chiqaruvchilar bilan iste’molchilar, mamlakatlar va qit’alar orasida bog‘lovchi qism bo‘lib, muhim iqtisodiy, ijtimoiy va strategik vazifalarni bajaradi. Ular mamlakatlar va hududlar orasida, ichki va tashqi bozorda yuzaga kelgan yangi omillar va yo‘nalishlarni hisobga olib, yuqori darajada transport ta’minotini amalga oshiradilar. Iqtisodiy aloqalarning jadal rivojlanishi shunga mos holda yuk tashishni rivojlanishini taqozo etadi. Yo‘lovchilarni tashish jamiyat uchun zaruriydir, ijtimoiy ahamiyatga ega.

O‘zbekiston avtotransporti taraqqiyotining tarixi davomida, avtomobilchilar iqtisodiyot va aholining yuk tashishga bo‘lgan talabini, avtotransportning mumkin bo‘lgan imkoniyatlari va afzalliklaridan foydalanib ta’minlab kelganlar. O‘zbekiston avtoyuk tashuvchilari, an’anaviy ravishda, o‘zlari ko‘rsatayotgan xizmatlari sifati bilan respublika tashqarisida ham ma’lumdirlar. Hozirda avtomobil

transporti respublikaning 85,0% dan ko‘proq miqdordagi yuklarini tashiydi, umumiy yuk aylanmasida uning ulushi 22,5% tashkil etadi.[1,2,3]

Kommunikatsiyalarning mamlakat hayotidagi muhim ahamiyatini e’tiborga olib, O‘zbekiston Respublikasi Prezidenti bir necha bor O‘zbekiston uchun kommunikatsiyalar muhim ahamiyatga egaligini ko‘rsatib o‘tgandi. Ta’kidlashicha: «Transport tarmoqlari va kommunikatsiyalarni rivojlantirish masalasi, O‘zbekistonning geografik joylashishining xususiyatlariga binoan, bandargohlarga va yirik transport uzellariga chiqishning yo‘qligi, ustivor, strategik, hayotiy ahamiyat kasb etadi. Kommunikatsiyalar tizimini rivojlantirmasdan O‘zbekiston kelajagi bo‘lmaydi va buni biz aniq tushunib yetishimiz kerak».

Hozirgi sharoitda xalq xo‘jaligining ko‘pchilik yirik sub’ektlarini va mamalakat har bir hududining jo‘shqin va tinimsiz rivojlanishi yaxshi tashkil etilgan avtomobil yo‘llari tarmog‘i bilan mahkam bog‘langan. Aynan avtomobil yo‘llarga xos omillar, transportdan foydalanishni osonlashtirish va yuk tashishni arzonlashtirish, borgan sari iqtisodiyotning rivojlanishini belgilovchi omil bo‘lib qolmoqda.

Avtomobil yo‘llari O‘zbekiston xalq xo‘jaligining muhim tarmoqlaridan biridir. O‘zbekiston o‘zining geopolitik holatiga ko‘ra juda katta yuk tashish va hududidan yuklarni olib o‘tish (tranzit) imkoniyatlarga ega. Mamlakatning to‘g‘ridan-to‘g‘ri dengiz bandargohlarga chiqish imkoniyatlari yo‘qligi uning transport tizimining o‘ziga xos xususiyatidir. Ana shu holatdan kelib chiqib, O‘zbekiston transport infrastrukturasini hududiy transport tizimiga samarali rivojlantirish, qo‘shni hududlar bilan va dengiz bandargohlari bilan maqsadga muvofiq transport yo‘laklarini ochish masalalarini hal qilish mamlakatning rivojlanishi uchun zarur sharoit yaratishning muhim omillaridir.

Avtomobil yo‘llari tarmoqlarining holati, ularning umumiy uzunligi va shakli-shamoyili (konfiguratsiyasi) xalq xo‘jaligining yuk va yo‘lovchilarni tashishga bo‘lgan talabini qondiradi. Respublika avtomobil yo‘llari tarmoqlari rivojlanishining asosiy o‘lchamlari bo‘yicha MDH mamlakatlari orasida, shuningdek Markaziy Osiyoda ham, peshqadam o‘rinlarda. Bugungi kunda O‘zbekiston Respublikasida avtomobil yo‘llari tarmog‘ining uzunligi o‘tkazilgan xatlov natijalariga ko‘ra 209 496 kmni (umumiy foydalanishdagi avtomobil yo‘llari – 42 869 km, xo‘jaliklararo qishloq avtomobil yo‘llari, shaharlar, shahar posyolkalari, qishloqlar va ovullar ko‘chalari – 141 882 km, idoraviy va inspektorlik yo‘llari – 24 745 km) tashkil etadi.

2017-2022 yillarda jami 80 531 km avtomobil yo‘llari qurildi, rekonstruksiya qilindi va ta’mirlandi shuningdek, 1 265 dona ko‘priklar va yo‘l o‘tkazgichlarni rekonstruksiya qilindi va ta’mirlash ishlari amalga oshirildi.[2,4]

O‘zbekiston Respublikasining xalqaro transport koridorlari hisoblangan xalqaro ahamiyatdagi A-380 “G‘uzor-Buxoro-Nukus-Beyneu” avtomobil yo‘lining 195 km, A-373 “M-39 avtomobil yo‘li-Guliston-Bo‘ka-Angren-Qo‘qon va Andijon orqali-O‘sh” avtomobil yo‘lining 140 km, M-39 “Olmaota-Bishkek-Toshkent-Termiz” avtomobil yo‘lining 179 km, M-37 “Samarqand-Buxoro-Turkmanboshi” avtomobil yo‘lining 71 km, “Qarshi-Shahrisabz” yo‘nalishidagi avtomobil yo‘lining 21 km qismlari rekonstruksiya qilindi.[2,4]

Qashqadaryo viloyatida barcha davlat dasturlari asosida 757,5 km yo‘llar ta’mirlanndi, 17 ta ko‘priklar qayta qurildi: investitsiya dasturi asosida 19 km avtomobil yo‘llari, xalqaro moliya institutlari Saudiya taraqqiyot jamg‘armasi va Quvayt Arab taraqqiyot jamg‘armasi mablag‘lari hisobidan 4R87 “G‘uzor-Chim-Ko‘kdala” avtomobil yo‘lining 38 - 73 kmlarida 35 km avtomobil yo‘li foydalanishga topshirilishga topshirildi./3/ Prezidentimizning 2022 yil 28 dekabrdagi tegishli qaroriga asosan bugungi kunda avtomobil yo‘llari tizimini yaxshilash bo‘yicha xalqaro moliya institutlarining 834,5 mln dollarlik 5 ta loyiha amalga oshirilmoqda. Bu orqali 2026 yil yakuniga qadar respublikada 993,4 km uzunlikdagi, jumladan 754 km sement-beton qoplamali va 239 km asfalt-beton qoplamali jahon standartlariga javob beradigan avtomobil yo‘llari to‘liq foydalanishga topshiriladi. Shuningdek, 2023-2027 yillar davomida 920,9 mln dollarlik 5 ta loyiha amalga oshirilgan holda, 177 km uzunlikdagi magistral va 1 947 km uzunlikdagi mahalliy ahamiyatga ega yo‘llar ta’mirlanib, foydalanishga topshirilishi rejalashtirilgan. [3,4,5]

Yo‘l tarmoqlarining dasturiy tadbirlari yagona modernizatsiyalashgan (yangilangan) avtoyo‘llar tarmoqlarini shakllantirishga va uni Yevropa va Osiyoning xalqaro ahamiyatga ega avtomobil yo‘llari tizimiga birlashtirishga (integratsiyalashga) yo‘naltirilgan.

Avtomobil yo‘llarini modernizatsiyalashga, yo‘l qoplamalarini kuchaytirishga va kengaytirishga, ko‘priklarni va ulardagi sun’iy inshootlarni ta’mirlashga, suv uzatkich tizimini takomillashtirishga, meyoriy talablarni t a’minlash uchun ba’zi bir yo‘l bo‘laklarini (uchastkalarni) qayta qurishga, yo‘l belgilarini hamda to‘siqlarni va yo‘lning boshqa kerakli injenerlik uskunalarini o‘rnatishga alohida e’tibor berilmoqda.

O‘zbekiston Respublikasi hukumati xalq xo‘jaligini ko‘tarish, uni jahon iqtisodiyotiga birlashtirish uchun ulkan ishlarni izchillik bilan amalga oshirayapti. Bu yo‘nalishda, o‘z kommunikatsiyalarini rivojlantirishni alohida e’tiborga olib, 1999 yil 19 avgustda O‘zbekiston Respublikasi Vazirlar Mahkamasi «Yevropa-Osiyo qit’alararo avtomagistralining O‘zbek bo‘lagi Andijon-Toshkent-Nukus-Qo‘ng‘irot trassasini, qo‘shni davlatlarga chiqish imkoniyatini hisobga olgan holda,

Andijon-Toshkent-Nukus-Qo‘ng‘irot tez yurar avtomagistrali qurilishini loihalashtirish haqida» qaror qabul qildi.

Qarorda begilanishicha, loyiha yechimlari jahon standartlari darajasida, rivojlangan mamlakatlarda 10-20 yil istiqbolga ishlanayotgan va qabul qilinayotgan texnik yechimlarni hisobga olgan holda, bu avtomagistral O‘zbek milliy tez yurar avtomagistrallar tizimini yaratish uchun asos bo‘lishini hisobga olgan holda, qabul qilinishi kerak. Xalqaro kelishuvlar va O‘zbekiston Respublikasi hukumati qarorlarini amaliy ro‘yobga chiqarish maqsadida Transport vazirligi katta miqyosdagi ishlarni amalga oshirmoqda. Murakkab baland tog‘li sharoitlarda avtotransport vositalari harakatini to‘xtatmasdan, Andijon-Toshkent-Nukus-Qo‘ng‘irot tez yurar avtomagistralining qismi bo‘lgan, Toshkent-O‘sh avtomobil yo‘lining Angren va Xonobod shaharlari orasidagi bo‘lagi yangilangan. Qisqa vaqt ichida Qamchiq va Rezak dovonlaridan o‘tadigan avtoyo‘l tunneli qurildi va foydalanishga topshirildi va shu bilan Ulug‘ Ipak Yo‘li tiklana boshladi.

Avtomagistral Qirg‘iziston Respublikasi chegarasida, O‘sh shahri yaqinida (Andijon viloyatidagi O‘zbekiston Respublikasi bilan Qirg‘iziston Respublikasi davlat chegarasida) boshlanadi va Andijon, Namangan, Farg‘ona, Toshkent, Sirdaryo, Jizzax,1 Samarqand, Navoiy, Buxoro, Xorazm viloyatlari, hamda Qoraqalpog‘iston Respublikasidan o‘tadi. Shu bilan 10 ta viloyat va Qoraqalpog‘iston Respublikasini to‘g‘ridan-to‘g‘ri muhim transport arteriyasi bilan o‘zaro bog‘laydi.

Avtomagistralning oxiri O‘zbekiston Respublikasi doirasidagi Qirqqiz turar joyi va u Benay shahriga (Qozog‘iston Respublikasi) boruvchi kollektor yo‘lga tutashadi. Trassa joylar relyefining hamma turlari bo‘yicha yo‘naltirilgan. Trassa rejasini loyihalashtirishda, birinchi navbatda quyidagilarni ta’minlash hisobga olingan:

• tranzit yuklarni Respublika hududida Yevropa-Osiyo ko‘prigining qismidek tashish;

• tezyurar arterial magistralda ichki yuk va yo‘lovchilar tashishni yirik yuk yig‘ilish nuqtalariga shaxobcha yo‘llar chiqarib amalga oshirish;

• qisqa vaqt ichida, hozirda ishlab turgan aloqalarni saqlash, Respublika aholi yashaydigan joylar orasida uzluksiz, xavfsiz harakatni ta’minlash.

Transport vositalarining yuqori tezlikda harakatlanishini ta’minlash uchun aholi yashaydigan joylarni aylanib o‘tish ko‘zda tutilgan, yirik shaharlar (Andijon, Farg‘ona, Qo‘qon, Namangan, Olmaliq, Toshkent, Guliston, Jizzax, Samarqand, Kattaqo‘rg‘on, Navoiy, Buxoro, Gazli, Qizilravot, Urganch, Xiva, Nukus, Qo‘ng‘irot, Beynau) bilan aloqa esa shaxobcha kollektor yo‘llar yordamida amalga oshiriladi. Avtomagistral trassasini loyihalashtirishda sanoat komplekslarini,

muhandislik kommunikatsiyalarini, alohida ahamiyatga ega bo‘lgan va sug‘oriladigan yerlarni, qo‘riqxonalarni, ko‘llarni, tarixiy_madaniy ahamiyatga ega bo‘lgan joylarni aylanib o‘tishga, hamda irrigatsiya tizimi buzilishiga yo‘l qo‘ymaslik shartlariga yuqori darajada e’tibor berilgan. Shuningdek mavjud avtomobil yo‘llaridan foydalanish ham ko‘zda tutilgan. Avtomagistralning asosiy trassasi 1492 kmni tashkil etadi, shaharlarga olib boruvchi shaxobcha kollektor yo‘llar uzunligi esa 802 km. [1,2,3]

Avtomagistralning asosiy trassasi olti harakat tasmasiga ega, shaxobcha kollektor yo‘llar esa to‘rt tasmali. Boshqa yo‘llar va muhandislik kommunikatsiyalari bilan yondoshuvlar va kesilishuvlarni kamaytirish uchun qayta trassalash yoki mavjud inshootlarni qayta qurish ko‘zda tutilgan. Avtomobil yo‘llari bilan yondoshuv va kesilishuvlar turli sathlarda loyihalashtirilgan. Avtomagistral va shaxobcha kollektor yo‘llar mahalliy ahamiyatga ega bo‘lgan avtomobil yo‘llari bilan, irrigatsiya tizimining tekshirish yo‘llari bilan kesishganda transport yechimlari o‘rnatmasdan turli sathlardagi kesishmalar loyihalashtirilgan. Temir yo‘l bilan kesishmalar turli sathlarda loyihalashtirilgan. Tezkor avtomagistralda 850 ta ko‘prik, yo‘l o‘tkazgich, estakada va piyodalarning o‘tish joylari qurilgan. Loyihada, yuqori tezlikda harakat qiluvchi avtomobillarning xavfsizligini ta’minlash maqsadida, zamonaviy texnik yechimlar majmuasi ko‘zda tutilgan.
«Qo‘ng‘irot-Nukus-Toshkent-Andijon» avtomagistrali uch yuzdan ortiq infrastruktura obyektlarini (yonilgi quyish va texnik xizmat ko‘rsatish shaxobchalarini, kempinglarni, motellarni) o‘z ichiga olgan va bizning mamlakatimiz Yevroosiyo transport bozorida munosib qatnashchi bo‘lishiga imkoniyat beradi.

**Xulosa.** Hozirgi sharoitda xalq xo‘jaligining ko‘pchilik yirik subyektlarining rivojlanishi yaxshi tashkil etilgan avtomobil yo‘llari tarmog‘i bilan uzviy bog‘liq. O‘zbekiston o‘zining geopolitik holatiga ko‘ra juda katta yuk tashish va hududidan yuklarni olib o‘tish (tranzit) imkoniyatlarga ega. Aynan avtomobil yo‘llarini qurish va ulardan samarali foydalanish mamlakat iqtisodiyoti rivojlanishini belgilovchi muhim omil bo‘lib hisoblanadi.

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# AHOLI YASHASH JOYLARIDA ISTIROHAT BOG‘LARINI TASHKIL ETISH UCHUN YER TUZISH LOYIHALARINI ISHLAB CHIQISH

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***Annotatsiya.*** *Maqolada istirohat bog‘larini tashkil etish bo‘yicha chora tadbirlar, muommolar va takliflar atroflicha tahili qilingan.*

***Kalit so‘zlar****: yer fondi toifasi, yer fondi toifasini o‘zgartirish, yer tuzish loyihasi.*

***Аннотация:*** *В статье подробно анализируются мероприятия, проблемы и предложения по организации парков отдыха****.***

***Ключевыеслова:*** *категория земельного фонда, изменение категории земельного фонда, проект освоения земель.*

***Abstract:*** *The article analyzes in detail the activities, problems and proposals for organizing recreation parks*

***Keywords:*** *land fund category, land fund category change, land development project.*

**Kirish**.

Yangi O‘zbekiston dunyoga yuz tutmoqda. Dunyo - O‘zbekistonni e’tirof etmoqda. Buning zamirida so‘nggi yillarda mamlakatimiz Prezidenti Shavkat Mirziyoyevning tashabbuslari bilan olib borilayotgan inson qadri uchun tamoiyli muhim rol o‘ynamoqda desak, aslo mubolag‘a bo‘lmaydi. Kundan-kunga xalqimizning siyosiy qarashlarida va ma’naviyatida bo‘ladigan o‘zgarish hamda xalqimizning urfodatlarini tiklashga, ayni paytda ularni umuminsoniy qadriyatlar bilan boyitishga ustuvorlik berildi.

Bugun insoniyat global isish, iqlim o‘zgarishi kabi qator ekologik tahdidlar bilan to‘qnash kelmoqda. Ushbu havfli tahdidlarni kamaytirish va ekologik barqarorlikni ta’minlovchi tizimlardan biri aholi yashash hududlarida istirohat bog‘larini tashkil etish orqali masalaga yechim topish imkoniyati paydo bo‘ladi. Shu sababli ham ushbu mavzu dolzar bo‘lib hisoblanadi.

**Tadqiqot obyekti va uslublari.** Tadqiqot obekti sifatida Qashqadaryo viloyati Qarshi tumani Agrofirma massivi “Chaman” MFY hududidan 213,214,215,216,217,218,219-konturlaridagi jami: 38 gektar yer maydoni tanlab olindi.Maqolada geostatistik tahlillar qilish, obyektlarni geofazoviy bog‘lash, kartografik, masofadan zondlash, algoritmlash kabi usullardan foydalanilgan.

## 3. Natijalar va munozaralar.

Inson paydo bo‘libdiki, u doimo tabiat, tabiiy muhit bilan o‘zaro mushtaraklikda yashaydi, faoliyat yuritadi. Inson hayoti davomida uning butun borlig‘ida tabiiy-biologik va ijtimoiy ruhiy nisbati ko‘rinishida ham namoyon bo‘ladi. Inson tabiatning uzviy bir bo‘lagi bo‘lib hisoblanadi. Prezidentimiz Shavkat Mirziyoyev raisligida 2018 yil 26 aprel kuni “Obod qishloq” dasturiga muvofiq qishloqlarni obodonlashtirish ishlarini sifatli tashkil etish va jadallashtirish masalalariga bag‘ishlangan videoselektor yig‘ilishida davlat rahbari “xarob va fayzi yo‘q joyda yashayotgan aholining kayfiyati ham, kelajakka intilishi ham bo‘lmaydi. Ikkinchi tomondan, ular ham fuqarolarimiz, nima uchun ular sharoit yo‘q joyda yashashi kerak? Biz qishloqlarni obod qilsak, u yerdagi xalqning kayfiyati o‘zgaradi, ularda o‘z hayotini yanada yaxshilashga intilish paydo bo‘ladi, qishloqlar iqtisodiy o‘sadi. Buning natijasida Vatanimiz obod bo‘ladi va mamlakatimizning iqtisodiy yuksalishi uchun yana bir muhim turtki bo‘ladi” deb taqidlagan edi. Shu sababli ham respublikamizning har bir hududida juda ko‘p o‘zgarishlar amalga oshirilmoqda. Ayniqsa hududlarda aholi yashash uylarini misol qilib ko‘rsatish mumkin. Binolar joylashgan hududlardan kam bo‘lmagan miqdorda yashillik, istirohat bog‘lari, sayilgohlar bo‘lishi shart. Aks holda ekologik balans

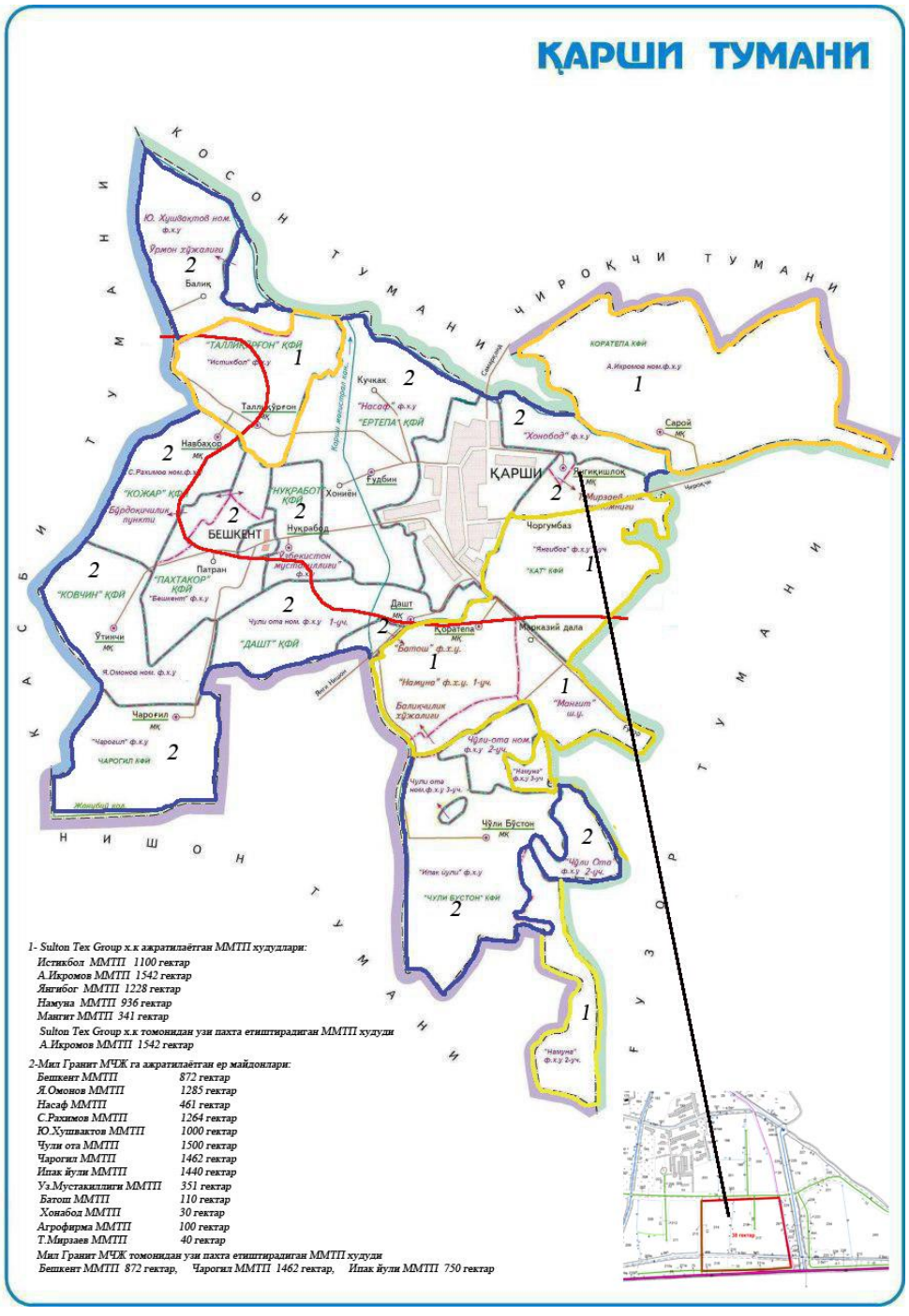
yo‘qoladi, bu tabiatning «jahlini chiqaradi». Jahli chiqqan tabiat esa insoniyatga aytaylik qurg‘oqchilik bilan «hujum qilishi mumkin». Shu sababli Qashqadaryo viloyati Qarshi tumani Agrofirma massivi “Chaman” MFY hududidan “Yangi O‘zbekiston” istirohat bog‘ini tashkil etish bo‘yicha yer tuzish loyihalarini amalga oshirdik.

Tajriba tahlil o‘tkazilgan hududning hududining iqlimi o‘zgaruvchan bo‘lib, katta suv havzalaridan uzoqligi – quruq va issiq yoz va sovuq – qish bilan hamda yog‘ingarchilikning yil davomida bir tekis tushmasligi bilan ajralib turadi. Eng sovuq kunlar yanvar, fevral oylarda kuzatilib, o‘rtacha havo harorati – 2,6–6,2$^0$S ni tashkil etsa, eng past harorat esa -29,0-30,0 $^0$S va eng yuqori harorat +41,0–43,0 $^0$S iyun–iyul oylarida kuzatiladi. Dastlabki qor yog‘ishi dekabr boshlarida kuzatiladi. Yog‘ingarchilik, asosan aprel va may oylarida ko‘p bo‘lib, bu davrlarda yillik yog‘inlar miqdorining 60-65 foizi tushadi. Yil davomida 177–252 mm gacha yog‘ingarchilik bo‘lishi kuzatiladi.

**Tuproq sharoiti**. Viloyat hududi uch xil morfologik guruhga, ya’ni adirlar (dengiz sathidan 1500 metr balandlikda), dasht va cho‘l hududlariga bo‘linadi. Tuproqlari och bo‘z tuproq, qumoq tuproq turlariga bo‘linadi. Tuproq tarkibida gumus miqdori 1,3- 1,8 %, yalpi azot –0,18-0,22 %, fosfor –0,14-0,18 % va kaliy –3,4- 6,2 % gacha o‘zgarib turadi. Ushbu hududdagi och tusli tuproqlar kuchsiz ishqoriy reaksiyaga (pH–7,2–7,4) ega, singdirish sig‘imi 100 g tuproqda 25-28 mg.ekv bo‘lib, almashinib yutiladigan kationlar yig‘indisini (5-8 %) kaliy hamda natriy tashkil etadi. Tuproqning pastki qatlamlarida (1,5-2 m) gips qatlami mavjud

O‘zbekiston Respublikasi Prezidenti Sh.M.Mirziyoyevning 2022-yil 21-22-aprel kunlari Qashqadaryo viloyatiga tashrifi davomida va Xalq deputatlari viloyat kengashining navbatdan tashqari sessiyasida bergan topshiriqlari bo‘yicha 35-soni yig‘ilish bayonining 13-bandida “Qarshi-Shahrisabz” avtomobil yo‘li bo‘yicha bosh reja konsepsiya loyihasini ishlab chiqish hamda mazkur topshiriq ijrosini ta’minlash maqsadida Qarshi tumani Chaman MFY hududidan 38 gektar maydonda “Yangi O‘zbekiston bog‘i” majmuasini barpo etish ishlari amalga oshirilmoqda. Ushbu loyihani amalga oshirish uchun Chaman MFY hududidan 213,214,215,216,217,218,219-konturlaridagi jami: 38 gektar yer maydoni tanlab olindi (1-rasm).

**Qashqadaryo viloyati Qarshi tumani «Agrofirma» massivi hududidan "Yangi O‘zbekiston bog‘i barpo etish" uchun tanlangan yer maydoni LOYIHA XARITASI**




**1-расм. Tanlangan yer maydonini loyiha xaritasi**

*Loyihalanayotgan hududning Google Earth xaritasidan olingan yer maydonini 2-rasmda ko‘rishimiz mumkin.*

*2-rasm.Google Earth xaritasidan olingan yer maydoni rasmi*


*1-jadval.*

*Loyihalanayotgan hududning konturlar bo‘yicha qaydnomasi.*

| T/r | Hudud nomi | Yerdan foydalanuvchi nomi | Kontur raqami | Jami yer maydoni, ga | Shundan | | Tuproq ball boniteti |
|---|---|---|---|---|---|---|---|
| | | | | | sugoriladigan yerlar, ga | boshqa yerlar, ga | |
| 1. | Agrofirma massivi | Tuman hokimligi zahirasidagi yerlar | 213 | 0,50 | | 0,50 | |
| | | | 214 | 9,01 | 9,01 | | 49,7 |
| | | | 215 | 0,40 | | 0,40 | |
| | | | 216 | 1,70 | 1,70 | | 49,7 |
| | | | 217 | 18,10 | 18,10 | | 49,7 |
| | | | 218 | 4,99 | 4,99 | | 49,7 |
| | | | 219 | 3,30 | 3,30 | | 49,7 |
| | | | **7** | **38,0** | **37,10** | **0,90** | **49,7** |

Joylashtirilishi mo‘ljallangan Qashqadaryo viloyati Qarshi tumani Agrofirma massivi “Chaman” MFY xududidan “Yangi O‘zbekiston” bog‘i barpo qilish loyihasini tashkil etish uchun obyektining jami 38,0 gektar yer maydoni bo‘lib, shundan; 32,11 gektar suvli, 4,99 gektar ko‘p yillik daraxtzorlar, 0,90 gektar boshqa yerlarni maydoni kelajakda foydalanish maksadiga ko‘ra qishloq xo‘jaligiga mo‘ljallangan (yoki o‘rmon

fondi) yerlari toifasidan yer fondining sanoat, transport, aloqa, mudofaa va boshqa maqsadlarga mo‘ljallangan yerlar toifasiga o‘zgartirish belgilandi.

Tanlangan yer maydonida dam olish va hordiq chiqarish, sport bilan shug‘ullanish joylari va yo‘laklar, amfiteatr, suniiy ko‘l havzasi, avtoturargohlar hamda mavzuli hududlar, shu jumladan kashtan,eman, chinor, lola va nastarin bog‘lari, noyob manzarali va qimmatbaho daraxtlar, butalar va gullardan iborat dam olish maskanlari barpo etish rejalashtirilgan(3-rasm).

**“Yangi O‘zbekiston” bog‘i sxemasi**


***3-rasm. “Yangi O‘zbekiston” bog‘ini tashkil etish loyihasi.***

**Xulosa, taklif va tavsiyalar:** Xulosa qilib aytganda, istirohat bog‘larini tashkil etish, aholi punktlarini ko‘kalamzorlashtirish va obodonlashtirish tadbirlarini amalga oshirib biz nafaqat atrof muxitni ifloslanishini oldini olamiz balki biologik xilma-xillik saqlash, cho‘llanishni oldini olishga va kelajak avlodlarning xam salomatligiga zamin yaratamiz.Respublikamizda keyingi yillarda amalga oshirilayotgan islohotlar asosan xalqimiz turmush darajasini yaxshilashga, farovonligini oshirishga qaratilgandir.

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# ПРОБЛЕМА ОБЕСПЕЧЕНИЯ ДОЛГОВЕЧНОСТИ И НАДЕЖНОСТИ СТРОИТЕЛЬНЫХ МАШИН И ИХ РАБОЧЕГО ОБОРУДОВАНИЯ

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***АННОТАЦИЯ***

*Эффективность эксплуатации строительно-дорожных машин определяется, в первую очередь, уровнем их надежности, который закладывается при проектировании изделия, обеспечивается при изготовлении, проявляется и поддерживается в эксплуатации. Общепринято понимать надежность как свойство изделия сохранять во времени в установленных пределах значения всех параметров, характеризующих способность выполнять требуемые функции в заданных режимах и условиях применения, технического обслуживания, ремонта, хранения и транспортировки. При этом параметры качества исполнительных поверхностей деталей наравне с конструкцией машин, качеством их сборки, режимом эксплуатации, другими аспектами оказывают существенное влияние на многие показатели эффективности работы машин, механизмов и технологического оборудования. Большинство машин (85-90%) выходит из строя по причине износа деталей. Расходы на ремонт машин в нашей стране составляют десятки миллиардов рублей в год.*

***Ключевые слова:*** *Долговечность, высотные здания, технологии защиты, композитные материалы, коррозия, строительные материалы.*

**Введение**

Процесс разработки грунта строительно-дорожными машинами характеризуется неблагоприятными условиями для элементов рабочих органов, которые непосредственно взаимодействуют с рабочей средой. При разработке техногенных грунтов (в частности, отвалов металлургических комбинатов) возникла проблема повышенного абразивного износа рабочих органов, которая не проявлялась в случае разработки природных грунтов. Таким образом, традиционные теории копания не в полной мере учитывают фактор абразивного действия грунта, в частности, при прогнозировании надежности рабочего оборудования строительно-дорожных машин. При затуплении режущей кромки происходит увеличение усилий, которое может достигать 180-200%. В известных теориях Ю.А. Ветрова, К.А. Артемьева и др. влияние износа на величину силы копания учитывается за 7 счет соответствующих поправочных коэффициентов (коэффициент затупления, относительное притупление лезвия и т.д.). Определены предельные значения площадки износа и радиуса, при достижении которых процесс разработки грунта становится нецелесообразным. Однако данные теории не учитывают влияния физико-механических свойств материала режущих органов и не позволяют учесть динамику изнашивания режущей кромки, а следовательно, и прогнозировать наработку, которая соответствует наступлению указанного выше предельного состояния, что снижает эффективность планирования ремонтных мероприятий. В практике применяются различные методы ремонта и восстановления шарниров рабочего оборудования. Реальный уровень восстановления потребительских качеств (оцениваемый в том числе и показателями надежности), составляет всего 40-50% (вместо нормативного значения в 80% согласно ГОСТ 22581-77). Сравнительно малая доля восстанавливаемых деталей объясняется тем, что используемые в ремонтном производстве технологии и оборудование не обеспечивают требуемых параметров качества поверхностного слоя (микротвердости, толщины упрочненного слоя, шероховатости и т.д.). Помимо этого традиционные методы упрочнения формируют слой, в котором микротвердость по толщине снижается. Такая ситуация порождаетне совсем благоприятный характер изменения интенсивности отказов: удлинение периода приработки и сокращение периода нормальной работы узла.

Одним из основных требований, которые предъявляются к машинам, является надежность. Проблема обеспечения надежности достаточно остро стоит во многих отраслях экономики. Например, по оценкам ГОСНИТИ, половина тракторов отечественного производства имеет крайне низкий ресурс наработки на отказ. Это приводит к тому, что 20-30% времени техника

простаивает по техническим причинам. Перспективной задачей является повышение наработки на отказ до ремонта до 8-10 тыс. мото-ч для тракторов и оборудования, средней наработки на сложный отказ до значений минимум 500-600 мото-ч. Требуемый уровень надежности закладывается при проектировании изделия, обеспечивается при изготовлении, проявляется и поддерживается в эксплуатации. Большой вклад в развитие вопросов обеспечения надежности машин на стадиях их жизненного цикла внесли разработки отечественных и зарубежных ученых К.П. Чудакова, А.С.Денисова, Д.П. Великанова, Ю.К. Беляева, Г.В. Крамаренко, Ф.Н. Авдонькина, Н.Я. Говорущенко, А.Д. Соловьева, Я.Б. Шора, Е.С. Кузнецова, Я.Х, Закина, Я,И, Несвитского, Р. Барлоу, Дж. Хунтера, Ф. Прошана, В Радановича, С.В. Репина, Ю.И. Густова, В.А. Зорина и др. Ученые сходятся во мнении, что в процессе эксплуатации машин техническое состояние их элементов изменяется, что в конечном итоге приводит к отказам. В таблице 1.1 приведены некоторые данные по причинам отказов.

Таблица 1– Некоторые данные по причинам отказов машин

| № | Причины отказов в процентах | Причины отказов в процентах | | | |
|---|---|---|---|---|---|
| 1 | Изнашивание | 40 | 50 | 49.4 | 46.0 |
| 2 | Пластическая деформация | 26 | 35 | 17.5 | 1.1 |
| 3 | Усталостное разрушение | 18 | 35 | 15.5 | 13.4 |
| 4 | Тепловое разрушение | 12 | 15 | 14.1 | 13.5 |
| 5 | Коррозия | - | 15 | 0.3 | 3.8 |
| 6 | Прочее | 4 | - | 3.2 | 23.2 |

Из таблицы 1 видно, что основной причиной отказов является изнашивание. Причем исследователи отмечают, что изнашивание является причиной закономерных отказов, тогда как пластическая деформация или усталостное разрушение чаще всего связаны либо с конструкторскими недоработками, либо с нарушением условий эксплуатации машины. Указное выше обстоятельство требует проведения мероприятий по поддержанию работоспособности машины. В таблице 2 приведены данные по соотношению затрат на поддержание работоспособности к стоимости машины.

**Таблица 2 - Отношение затрат на поддержание работоспособности и стоимости машин за срок службы**

| № | Машины | Отношение, % |
|---|---|---|
| 1 | Автомобили | 600-800 |
| 2 | Тракторы | 500-650 |
| 3 | Металлорежущие станки | 800-1500 |
| 4 | Самолеты | 500-600 |
| 5 | Строительные и дорожные машины | 700-850 |

Как видно из таблицы 2, указанное соотношение для строительнодорожных машин весьма существенное. Проблема также усугубляется тем, что наблюдается общее старение парка техники.

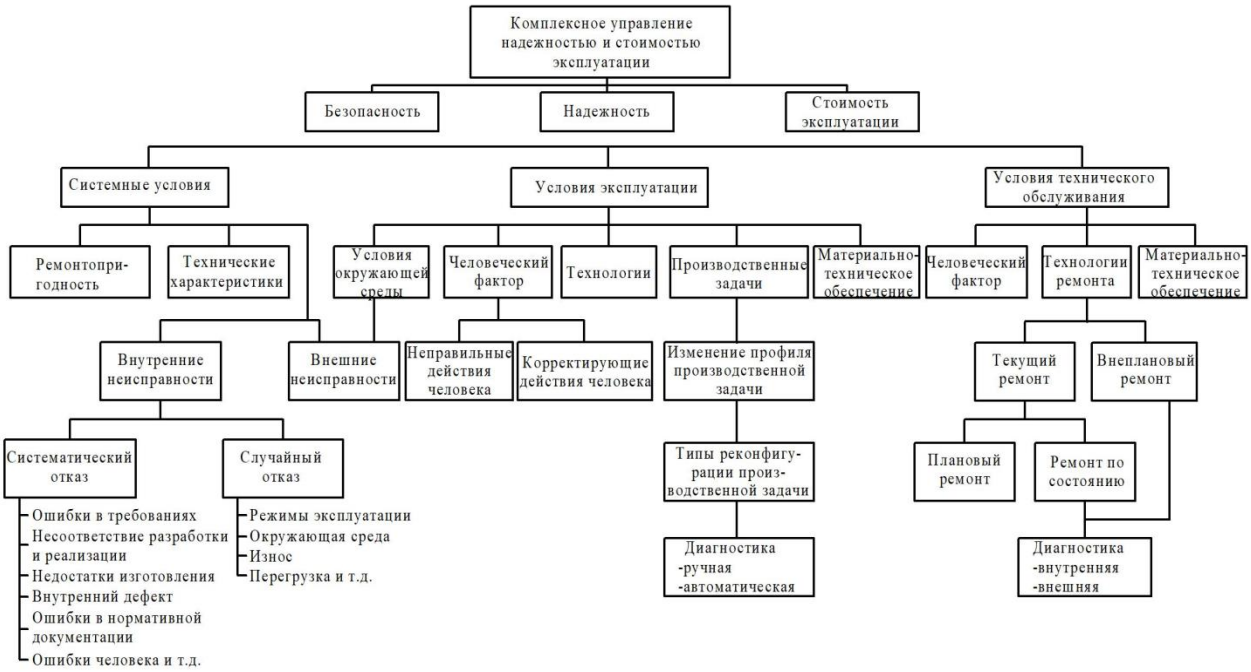


Рисунок 1 – Схема комплексного управления надежностью и стоимостью строительно-дорожных машин

Среди основных причин снижения количества техники, находящейся в эксплуатации можно выделить снижение объемов производства машин, резкий рост их стоимости и увеличение доли изношенной техники. В целом, степень обновления парка машин составляет всего 1.5-2%, при нормативных ее значениях в 8-9%. Помимо этого, наблюдается непрерывный рост количества техники иностранного производства, который только за последние 5 лет составил около 25%. Учитывая девальвацию рубля, такая доля иностранной

техники оказывает существенное влияние на экономическую эффективность предприятий отрасли. Надежность является комплексным свойством, и ее обеспечение требует учета большого количества факторов на всех стадиях жизненного цикла машины. Причем среди комплекса факторов, которые влияют на формирование и поддержание надежности, можно отметить не, только конструктивные, но и технологические, эксплуатационные аспекты. Отдельно стоит выделить влияние человеческого фактора, т.к. оно практически всегда непрогнозируемое. На рисунке 1 приведена декомпозиция факторов.

**Результаты**

На основании проведенного анализа состояния вопроса можно сделать следующие выводы:

- наиболее частой причиной отказов строительно-дорожных машин и их рабочего оборудования является изнашивание, приводящее к тому, что довольно продолжительный период времени машины простаивают по техническим причинам. Выход из данной ситуации видится в повышении надежности строительно-дорожных машин и их агрегатов на всех этапах жизненного цикла;

- ресурс быстроизнашивающихся частей рабочего оборудования строительно-дорожных машин существенно меньше срока службы машины. Изменение их состояния приводит к росту нагрузок на силовые приводы строительно-дорожных машин и снижению производительности. Для повышения долговечности быстроизнашивающихся частей, особенно в условиях абразивного износа, целесообразно использовать композиционные материалы и поверхностное упрочнение;

- состояние парка строительно-дорожных машин в Российской Федерации характеризуется высокой долей техники со сроком эксплуатации более 15-20 лет (по некоторым типам она достигает 70%), при этом обновление идет достаточно медленно. Из этого следует, что все большую актуальность приобретают вопросы ремонта и восстановления;

- исследования отечественных и зарубежных ученых показывают, что в среднем только 15-20% изношенных деталей строительно-дорожных машин подвергаются восстановлению. Таким образом, совершенствование ремонта и восстановления элементов строительно-дорожных машин является эффективным способом повышения надежности машин;

- при использовании традиционных методов поверхностного упрочнения наблюдается уменьшение твердости по толщине слоя. Данная ситуация порождает не совсем благоприятный характер изменения интенсивности от 47 казов: удлинение периода приработки и сокращение периода нормальной работы узла. Формирование обратного распределения твердости дает возможность преодолеть данную проблему.

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# ОПТИМИЗАЦИЯ ПАРАМЕТРОВ ПРУТКОГО ИНТЕНСИФИКАТОРА КАРТОФЕЛЕКОПАТЕЛЯ С МЕТОДОМ МАТЕМАТИЧЕСКОГО ПЛАНИРОВАНИЯ

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***Аннотация.*** *В данной статье методом математического планирования многофакторных экспериментов определены оптимальные значения параметров картофелекопалки, оснащенной эластичным прутковым интенсификатором, полученные в однофакторных экспериментах. При этом считается, что влияние факторов на критерии оценки полностью объясняется полиномом второго порядка, и эксперименты проводились по плану Хартли-4 ($X_4$).*

***Ключевые слова:*** *оптимизация, параметр, интенсификатор, картофель, степень сепарирования почвы, степень повреждения картофеля, степень потери картофеля.*

Картофель – один из основных продуктов питания для человека. Растущее население мира увеличивает спрос на картофель наряду с другими продуктами питания. В связи с этим использование энергосберегающих машин с высокой производительностью при уборке картофеля занимает одно из ведущих мест. «Согласно отчету Продовольственный и сельскохозяйственной организации Объединенных Наций от 30 мая 2022 года, учитывая, что в 2020 году картофель был посажен на площади более 20 миллионов гектаров в 150 странах мира, с годовым производством 359 миллионов тонн урожая, производство картофеля к 2025 году увеличится до 500 млн. тонн, к 2030 году планируется достичь 750 миллионов тонн»[1], что необходимо внедрить в практику технические средства и вооружение, обеспечивающие уборку картофеля с высокой

производительностью и качеством и низким расходом топлива. Исходя из этого, важно освоить производство машин с качественными, технически и технологически совершенными, энергосберегающими и энергосберегающими рабочими органами и использовать их при уборке картофеля.

Сегодня во всем мире проводятся научно-исследовательские работы, направленные на совершенствование высокоэффективных, в малой степени повреждающих клубней картофеля, ресурсосберегающих методов и технических средств уборки картофеля. В частности, особое внимание уделяется совершенствованию способов уборки картофеля, созданию машин с высокой эффективностью рабочих органов, обоснованию технологического процесса и параметров их работы.

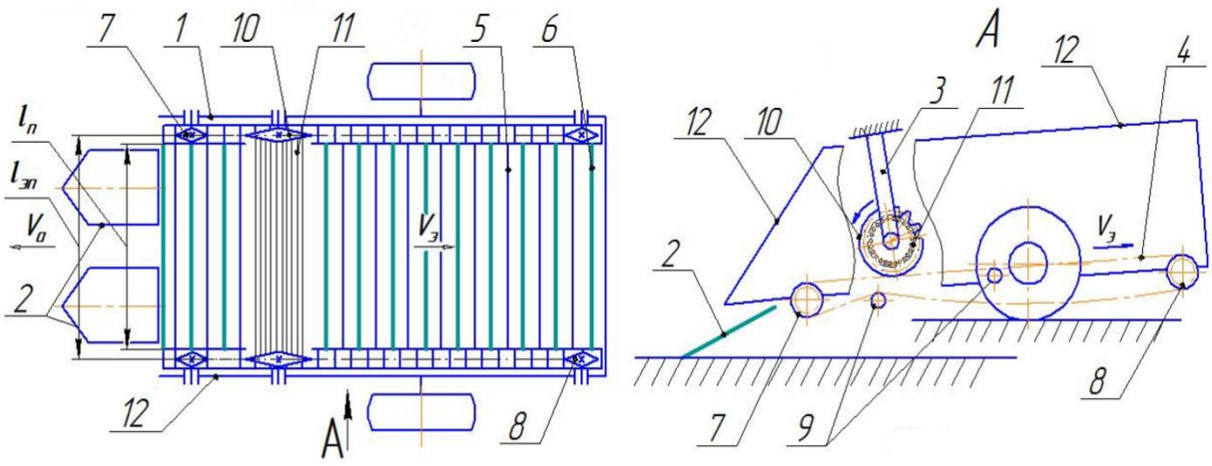
Уборка картофеля – один из самых трудоемких процессов при выращивании картофеля. В настоящее время 75% всех затрат в производстве картофеля связано с процессом уборки урожая. В условиях почвенно-климата нашей республики (высокая летняя температура, низкая относительная влажность, уплотнение почвы вследствие орошения) картофелеуборочные машины не привели к их широкому использованию. Потому что результаты испытаний картофелеуборочных машин показали, что в процессе уборки снижается уровень просеивания в элеваторах и решетах и становится затруднительно отделить картофель от почвы из-за того, что почвенный слой картофельной грядки недостаточно хорошо измельчается и разделены на крупные куски почвы [2].

Поэтому процесс уборки картофеля в Узбекистане осуществляется импортными картофелекопалками. В связи с тем, что картофель выкапывается этими машинами и сбрасывается на поверхность почвы неравномерно, при его уборке требуется много затраты руч труда. В элеваторах существующих картофелекопалок из-за низкого процесса просеивания почвы и твердых почвенных частей картофеля и отделения их от картофеля наблюдаются повреждения и потери клкубней картофеля, превышающие установленные агротехнические требования.

Исходя из вышеизложенного, данная работа является одной из актуальных задач по созданию технической и технологической основы разработки энергоресурсосберегающей картофелекопалки для почвенно-климатических условий нашей Республики. Развитые зарубежные страны, производящие картофелекопалки, показывают, что необходимо реализовать и изучить несколько технических решений, чтобы снизить энергопотребление картофелекопалки и улучшить качество ее работы. Сначала, чтобы раздробить на поверхности элеватора картофелекопалки твердые комки, отрицательно

влияющие на качество работы картофелекопалки, целесообразно у в начале технологического процесса на картофелекопательную машину устанавливают специальное опорно-комкоразрушаюшие устройство. Затем уменьшите расстояние между лемехами, затем выкопатель нужную часть картофельной грядки и разложитс ее на решетах, количество элеваторов следует уменьшить, чтобы переносить меньше массы почвы и повысить уровень их просеивания, а также уменьшить потери и повреждения клубней картофеля.

В связи с этим для обеспечения уровня просеивания почвы в соответствии с агротехническими требованиями за счет уменьшения объема металла без увеличения количества решет картофелекопалки на одно предлагается конструкция картофелекопалки с эластичными прутками, на его эластичные прутковые интенсификаторы. Интенсификатор состоит из двух зубчатых звездочек и оси, соединяющей их из центров, а также установленных по их периметру эластичных прутков. Зубчатые звездички интенсификатора установлены на цепных передач, и за счет движения решета картофелекопалки оно вращается, то есть для перемещения пруткого интенсификатора не требуется никаких дополнительных цепных передач. Конструкция картофелекопалки, оснащенной прутковым интенсификатором, состоит в следующем (рис. 3.1).




1-рама; 2- подкапывающего лемеха; 3-стойка интенсификатора; 4- основною элеватора; 5- прутка элеватора; 6- эластичною прутка; 7, 8-едущей и ведомой звездочки; 9- натяжного ролик; 10- зубчатой звездочки интенсификатора; 11- эластичных прутков интенсификатора; 12- корпусов машин.

**Рис. 1. Схема конструкции картофелекопателя, оснащенного эластичными прутками [3]**

С целью определения оптимальных значений параметров картофелекопателя, оснащенного интенсификатором с эластичными прутками в однофакторных экспериментах были определены оптимальные значения с использованием метода математического планирования многофакторных экспериментов. При этом считалось, что влияние факторов на критерии оценки полностью объясняется полиномом второго порядка, и эксперименты проводились по плану Хартли-4 ($X_4$)[4,5].

По результатам теоретических исследований и однофакторных экспериментов наибольшее влияние на повреждение и потери картофеля оказывают следующие параметры: диаметр звездочки интенсификатора, количество прутков, диаметра плетеного круга по периметру звездочки интенсификатора, скорость движения агрегата, степень сепарирования массы картофельной почвы. Факторы условно определялись следующим образом: $X_1$ – диаметр звездочки пруткового интенсификатора, $X_2$ – количество прутковых интенсификатора, $X_3$ – диаметра плетеного круга по периметру звездочки интенсификатора и $X_4$ – суммарная скорость движения.

*Таблица 1. Факторы, их обозначения, интервал варьирования и уровни*

| Факторы и их единицы измерения | Условной обозначения | Интервал варьирования | Уровни | | |
|---|---|---|---|---|---|
| | | | Ниже (–1) | Основной (0) | Верхный (+1) |
| Диаметр звездочки пруткового интенсификатора, м | $X_1$ | 0,05 | 0,5 | 0,55 | 0,6 |
| количество прутковых интенсификатора, шт. | $X_2$ | 5 | 30 | 35 | 40 |
| диаметра плетеного круга по периметру звездочки интенсификатора, м | $X_3$ | 0,01 | 0,28 | 0,29 | 0,3 |
| Суммарная скорость движения, м/с | $X_4$ | 0,2 | 0,8 | 1,0 | 1,2 |

При проведении многофакторных экспериментов в качестве критериев оценки принимались степень сепарирования почвы $Y_1$ (%), степень повреждения картофеля $Y_2$ (%) и степень потери картофеля $Y_3$ (%).

С целью снижения влияния неконтролируемых факторов на критерии оценки последовательность экспериментов определялась с помощью таблицы случайных чисел.

Данные, полученные в экспериментах, обрабатывались с помощью программы «PLANEXP». Для оценки однородности дисперсии использовался критерий Кокрана, для оценки значения коэффициентов регрессии – критерий Стьюдента, для оценки адекватности регрессионных моделей – критерий Фишера.

Полученные в экспериментах данные были обработаны в указанном выше порядке и получены следующие уравнения регрессии, адекватно представляющие критерии оценки:

- степень сепарирования картофельно-почвенной массы, %:

$$\%: Y_1 = 81{,}7 + 0{,}45X_1 + 0{,}87X_2 + 0{,}42X_3 + 0{,}25X_4 - \\ -1{,}17X_1^2 + 0{,}51X_1X_2 - 0{,}47X_1X_4 - 0{,}31X_2^2 - \\ +0{,}56X_2X_3 + 0{,}30X_2X_4 + 0{,}61X_3^2 + 0{,}21X_3X_4 - 0{,}98X_4^2; \quad (1)$$

- степень повреждения картофеля, %:

$$Y_2 = 2{,}61 + 0{,}028X_1 + 0{,}025X_2 + 0{,}032X_3 - 0{,}027X_4 + \\ +0{,}039X_1^2 + 0{,}015X_1X_2 + 0{,}017X_1X_3 + 0{,}018X_1X_4 - 0{,}015X_2^2 + \\ +0{,}020X_2X_3 + 0{,}032X_2X_4 + 0{,}014X_3^2 - 0{,}025X_3X_4 + 0{,}019X_4^2; \quad (2)$$

- степень потери картофеля, %:

$$Y_3 = 2{,}85 - 0{,}051X_1 - 0{,}088X_2 - 0{,}040X_3 + 0{,}11X_4 + \\ -0{,}015X_1^2 - 0{,}027X_1X_2 - 0{,}027X_1X_3 + 0{,}033X_1X_4 - 0{,}055X_2^2 + \\ +0{,}021X_2X_3 - 0{,}019X_2X_4 - 0{,}024X_3^2 + 0{,}20X_4^2; \quad (3)$$

Решения уравнений регрессии (1)-(3) с целью обеспечения требуемого качества работы при малых энергозатратах при скорости движения 0,8-1,2 м/с показали, что диаметр звездочки пруткового интенсификатора 0,55 м, количество эластичных прутков составляет 35 штук, диаметр круга, установленого по периметру звездочки пруткового интенсификатора, должна составлять 0,29 м.

При этих значениях факторов степень сепарирования картофельно-почвенной массы составила 83,1 процента, а степень повреждения и потери картофеля - менее 3 процентов.

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# G‘O‘ZA QATOR ORALARIGA KUZGI BUG‘DOY EKISH UCHUN TUPROQQA ISHLOV BERISHNING YANGICHA USULLARI

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***Annotatsiya.*** *Maqolada g‘o‘za qator oralariga kuzgi bug‘doy ekish uchun tuproqqa ishlov beradigan yaxshi uvalangan tuproq qatlamini hosil qiladigan energiyatejamkor samarali texnologiya va uni ta’minlaydigan texnik vositalarni o‘rganib chiqqan holda yangi qurolni ishlab chiqish bo‘yicha tavsiya va ko‘rsatmalar berilgan.*

***Tayanch so‘zlar:*** *g‘o‘za, ishlov berish, ishchi qurol, energiyatejamkor texnologiya, tuproq maydalagich, profil, ko‘ndalang kesim.*

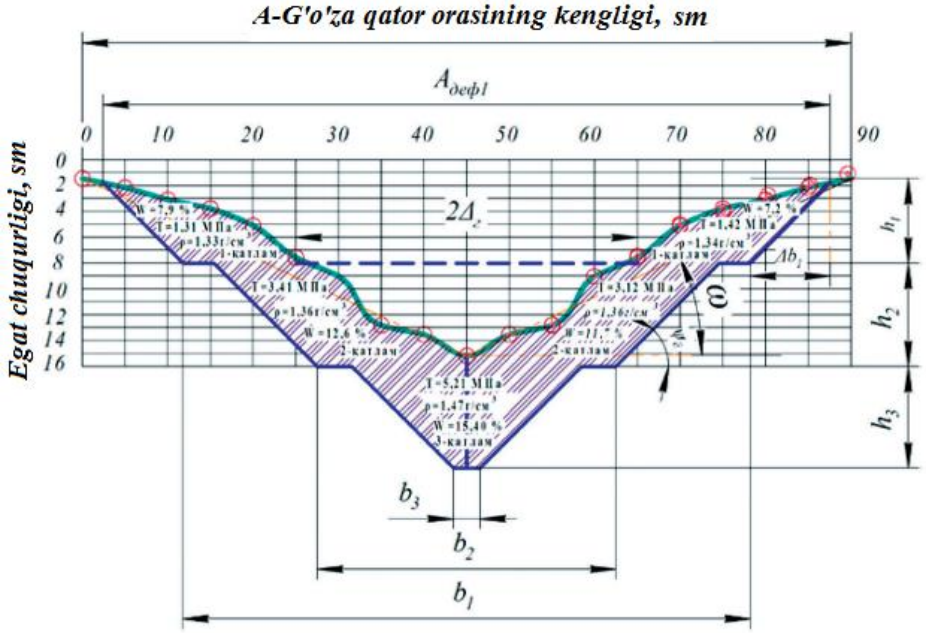
**Kirish.** Jahonda g‘alla va boshqa donli ekinlarni ekish texnologiyalari va texnik vositalarini yaratish asosida ishlab chiqarishni samarali o‘sishini ta’minlash muhim o‘rin egallaydi. “Hozirgi kunda dunyo miqyosida 215 mln. gektardan ortiq maydonga g‘alla ekilib, yiliga 730 mln. tonnadan ko‘proq don hosili yetishtirilmoqda” [1]. Dunyo bo‘yicha don mahsulotlarini ishlab chiqarish va uni iste’mol qilish darajasining ortib borishi sababli g‘alladan yuqori hosil olish uchun tuproqqa sifatli ishlov beradigan va ekadigan resurstejamkor, texnik va texnologik jihatdan modernizatsiyalashgan texnika vositalarini tatbiq etishga alohida e’tibor qaratilmoqda. Jahon amaliyotida bug‘doy ekish texnologik jarayonlariga, ekish oldidan tuproqqa sifatli ishlov berishga, bug‘doy urug‘larini aniq ekishga, ularni tuproq ostida tekis taqsimlanishini ta’minlaydigan texnika va texnologiyalarni yaratishga alohida e’tibor qaratilmoqda. Ushbu yo‘nalishda bug‘doy urug‘larini tuproqqa bir yo‘la ishlov berib ekish usuli bilan energiyatejamkorligini, sifatli ishlov berilgan maydondan samarali foydalanish, ekish apparatlarining barqaror ishlashini ta’minlash va urug‘larni belgilangan me’yorda ekish usullari bilan resustejamkorlikni ta’minlash kabi yo‘nalishlarda maqsadli ilmiy izlanishlarni amalga oshirish muhim vazifalardan biri hisoblanadi.

**Asosiy qism.** Respublikamizda sug‘oriladigan yerlardan unumli foydalanishga, qishloq xo‘jalik ekinlaridan, jumladan, g‘alladan yuqori hosil olishni ta’minlovchi

zamonaviy yuqori samaradorlikka ega bo‘lgan resurstejamkor texnika va texnologiyalarni tatbiq etishga alohida e’tibor berilmoqda. Bu borada g‘o‘za qator oralariga kuzgi bug‘doy ekadigan agregatlarni ishlab chiqarish amalga oshirilib, muayyan natijalarga, jumladan, 7,5 mln. tonnadan ortiq bug‘doy yetishtirishga erishildi. Ushbu yo‘nalishda, jumladan, g‘o‘za qator oralariga mos parametrlarda ekish oldidan tuproqqa sifatli ishlov beradigan takomillashtirilgan, enegiya-resurstejamkorlikni ta’minlaydigan agregatlarni ishlab chiqish zaruriyati tug‘ilmoqda.

2022 — 2026-yillarga mo‘ljallangan Yangi O‘zbekistonning taraqqiyot strategiyasi to‘g‘risida O‘zbekiston Respublikasi Prezidentining farmonida ***30-maqsad: qishloq xo‘jaligini ilmiy asosda intensiv rivojlantirish orqali dehqon va fermerlar daromadini kamida 2 baravar oshirish, qishloq xo‘jaligining yillik o‘sishini kamida 5 foizga yetkazish*** vazifalari belgilab berilgan. Ushbu vazifani bajarishda, jumladan tuproqqa sifatli ishlov beradigan va ekadigan, texnika vositalarini texnik va texnologik jihatdan modernizatsiyalash hisobiga kuzgi bug‘doydan yuqori hosil olish va uning tannarxini pasaytirish muhim masalalardan biri hisoblanadi. Ko‘rib chiqilayotgan muammoning hozirgi holati va tahlili. G‘alla va boshqa donli ekinlarni ekish texnologiyalari va texnika vositalarini yaratish bo‘yicha ilmiy izlanishlar jahonning yetakchi ilmiy markazlari va oliy ta’lim muassasalari tomonidan olib borilgan va borilmoqda. G‘alla ekish texnologiyalari va texnika vositalarini yaratish bo‘yicha jahonda olib borilayotgan ilmiy-amaliy tadqiqotlar natijasida qator, jumladan, quyidagi ilmiy natijalar olingan: ochiq maydonlarga bug‘doy ekadigan seyalkalarning passiv bir diskli, ikki diskli, uch diskli, ankerli ekkichlarning tuproqqa ta’sir ko‘rsatadigan parametrlarini aniqlash uslublari ishlab chiqilgan; donli ekinlar urug‘larini ekishning pnevmomexanik usuli, ya’ni urug‘larni umumiy massadan ajratib olishning pnevmatik, ekkichlarga yetkazib berishning mexanik usuli hamda passiv ishchi qismli, qirqilgan, gofrli diskli pichoqlar va ikki diskli ekkichlar bilan yopishqoq, namligi yuqori tuproqlarni sifatli maydalanishini ta’minlab ekish usullari ishlab chiqilgan; don urug‘larini tuproq ostiga sepadigan ishchi organlarning parametrlarini asoslash, bir yo‘la ishlov beradigan va ekadigan agregatlarning funksiyalanish modellari, ularni hisoblash uslublari ishlab chiqilgan. Dunyoda bug‘doy ekish texnologiyalari va texnika vositalarini takomillashtirish bo‘yicha, qator ustuvor yo‘nalishlarda tadqiqotlar olib borilmoqda, jumladan: bug‘doy urug‘larini aniq ekishni ta’minlaydigan pnevmatik ekish apparatlarini urug‘larni massadan ajratib olishni takomillashtirish; urug‘larni tuproq ostiga sepadigan ishchi organlarning avtotebranishi hisobiga donli urug‘larni tuproq ostiga tekis taqsimlanishi va barqaror funksiyalanishini ta’minlaydigan ilmiy-texnik yechimlar ishlab chiqish; bir yo‘la ishlov berib, pushta yuzasi bo‘yicha bir xil chuqurlikda ekish sifatini ta’minlaydigan, yuqori ish unumlilik bilan ishlaydigan, zamonaviy energiya resurstejamkor

texnologiyalarni ishlab chiqish. Tuproqning xossalarini yaxshilash, g‘alla ekishning energiya resurstejamkor texnologiyalarini takomillashtirish, ekish oldidan ishlov beradigan va ekadigan mashinalar ishchi organlari tizimining tuproq bilan o‘zaro ta’sirlashuvi nazariyasini takomillashtirish, bug‘doy urug‘larini tuproq ostiga sepish va ekish chuqurligi bo‘yicha tekis taqsimlanishini ta’minlovchi samarali texnologiyalar va ishchi organlarning konstruksiyalarini yaratish sohasida ilmiy tadqiqotlar bir qator xorijiy va respublikamiz olimlari, nazariy va tajribaviy tadqiqotlarida ko‘rib chiqilgan va muhim natijalarga erishilgan [3, 4, 5, 6, 7, 8]. Lekin, amalga oshirilgan tadqiqotlar shudgorlanib, ekishga tayyorlangan ochiq maydonlar uchun ahamiyatli bo‘lib, egatli maydonlar, jumladan, g‘o‘za qator oralari tuproq sharoiti bo‘yicha ekish oldidan tuproqqa mukammal ishlov beradigan va belgilangan muddat, meyor hamda chuqurlikda sifatli ekadigan mashinalarning parametrlarini asoslash hamda konstruksiyalarini ishlab chiqish bo‘yicha tadqiqotlar yetarli olib borilmagan. Tahlillar natijalari g‘o‘za qator oralari tuprog‘iga kuzgi bug‘doy ekish oldidan sifatli ishlov berish to‘la joriy etilmaganligi kuzgi bug‘doydan barqaror yuqori hosil olish imkonini bermayotgani, kuzatuvlar va tajribalar agrotexnika talablariga to‘la javob bermasligi, bug‘doy urug‘larining tuproqqa chuqurroq tushib to‘planib qolgan joylarda qalin o‘sib chiqishi, tuproqdagi namlikning yetishmasligi natijasida sust unib chiqishi, ya’ni 14-16 kunda 85-90 foizni, 20 kundan keyin 95 foizni tashkil etishi, bir va ikki marta ishlov berilgan qator oralari profili o‘rtasida egat va pushta yonlari bo‘yicha tuproq notekisligining ortishi, shaklining o‘zgarishi, ko‘ndalang va bo‘ylama kesimlari bo‘yicha ham notekisliklarning mavjudligi urug‘larni ekish texnologik jarayoniga sezilarli ta’sir etishi, ishlov berilgandan keyin namlikning jadal yo‘qotilishini ko‘rsatdi.




**1-rasm. Ishlov berish yuzasining qatlamlar bo‘yicha taqsimlanish sxemasi**

**Taklif.** Kuzgi bog‘doy ekish oldidan tuproqqa samarali ishlov beradigan qurolni ishlab chiqish va uning konstruktiv parametrlari asoslash, jumladan: ekish oldidan tuproqqa qatlamlab ishlov beradigan, kuzgi bug‘doy ekadigan texnologiyalar asosida ishchi qurolning parametrlarini tuproqqa ta’sir etish jarayoni va ekish sifatiga bog‘liqligi asoslanadi; ekish oldidan tuproqqa qatlamlab ishlov berishni ta’minlaydigan ishchi qurolning ratsional parametrlari ishlab chiqiladi, ularning sifat va energiya sarfi ko‘rsatkichlari aniqlanadi; g‘o‘za qator oralariga ishlov berishda tuproqlarni deformatsiyalanish, uvalanish, egatning ko‘ndalang kesim profili bo‘yicha moslash usuli bilan takomillashtiriladi hamda ularning maqbul parametrlari asoslanadi; ekish oldidan tuproqqa qatlamlab ishlov berib, uning yuqori uvalanish darajasini ta’minlaydigan tekis yuzali egat shakllantiradigan qurolning energiya-resurstejamkorlikni taminlovchi texnologik va konstruktiv sxemalari ishlab chiqiladi.

**Xulosa o ‘rnida shuni ta’kidlash joizki,** g‘o‘za qator oralarini kuzgi boshoqli don ekinlarini ekishga tayyorlashda shunday e’tibor qaratilishi kerakki, g‘o‘zapoyalarni tagi ham tekis qilib yumshatilganda g‘o‘za qator oralariga urug‘ ekiladigan maydon kengayadi. Bu esa o‘z navbatida maydondagi maqbul ko‘chat qalinligini ta’minlaydi.

Tuproqqa ishlov berish tizimi noto‘g‘ri tanlanadigan bo‘lsa, eng yaxshi o‘tmishdosh ekin turi eng yomon bo‘lib qolishi mumkin.

Shuning uchun har bir yer maydonining holatini hisobga olgan holda, tuproqqa ishlov berish o‘z ijobiy natijasini beradi.

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# TECHNIQUES AND TECHNOLOGIES OF DIGGING POTATOES GROWN IN SMALL PLOTS

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***Abstract****. The article provides information on potato digging machines that are grown in small plots. Also, information on the justification of the parameters of potato digging machines is given.*

***Keywords:*** *potato, oscillating rod, energy efficiency, small areas, techniques and technologies, potato varieties.*

## 1. Introduction

At the end of 2022 in the Republic of Uzbekistan, potatoes were planted on the main arable land by 67.9 thousand hectares, and as a recurring crop, 28.6 thousand hectares were planted in 3.0 million hectares. tons of potatoes were delivered. Potatoes are grown mainly in Andijan, Namangan, Samarkand, Surkhandarya, Tashkent and Fergana regions. According to the Food and Agriculture Organization of the United Nations (FAO), potatoes are grown on 22 million hectares in 150 countries around the world and it is planned to double its volume in the next 10 years. Based on this, it is required to develop and put into practice tools for digging up the harvest root crops with high quality work and productivity, as well as with the lowest fuel consumption.

The total area cultivation in the Kashkadarya region is 65,945 hectares, which the area planted by the landlords is 60.214 hectares and the area cultivated on peasant farms is 5,731 hectares. From this it can be seen that potatoes are mainly planted by the landlords in small arable land (Fig.1). Since 91.3 percent arable land is made up land for land owners, the cultivation potatoes is handled in an individual manner. Growing potatoes in small contours is mainly 0.4-0.5 hectares and even smaller areas.

It is important for the national economy of our republic to develop a small-sized potato digger improved from the above and justify its parameters.

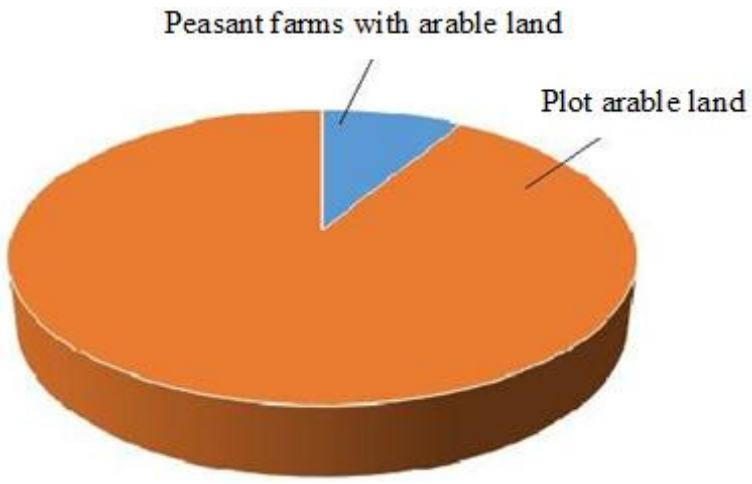


**Figure 1. Total arable land in landholders and farmers ‘ farms**

In vibratory-type potato diggers, trough-shaped ploughshares are mainly used. In elevator-type potato diggers, various types digging organs are used, which are divided according to the principle impact on the tuberous layer: passive, active and combined

However, these studies do not address the issues developing potato diggers with lattice ploughshares and forcibly oscillating working bodies for digging up the crop root crops and substantiating the technological processes their work and parameters. The purpose of the study is to substantiate the parameters lattice plowshare improved potato digger.

**2. Materials and methods**

The tasks of the research are as follows:

Regarding potato digging machines and their working bodies scientific and technical information and previously performed in this direction Analytical research of research works;

physico-mechanical properties of potato-planted field soil and egat study the terrain;

equipped with a grid plow and oscillating hivets construction and technological process of the potato digger justification;

A potato digger with an active working body with a grate and theoretical and experimental substantiation of the parameters and working mode of the khivs;

Experiments were carried out by aggregating a potato digger with a New Golland-110 tractor at a speed of 0.8-1.1 M/s aggregate. Experimental studies improved potato pickles were carried out in the summer season on farms Kashkadarya region Republic of Uzbekistan. The terrain field is flat, the soil experimental field is medium-light, sandy soil. The quality and energy indicators experimental potato digger

were evaluated according to the following indicators: the completeness potato digger; potato loss; damage to potatoes; drag resistance cowler. Drag resistance potato digger TST 63.03.2001 "Tests of agricultural machinery. Methods of energy assessment" was determined by using tenzometric fingers. One-factor experiments were carried out to determine the optimal parameters potato digger's lattice plowshare. Lattice ploughshares with different gripping widths and slots have been developed and manufactured for experimental studies. During the experiments, the degree damage and loss tuber, as well as the traction resistance potato digger were taken as evaluation criteria. The taxile transmitted literature [1, 5], an improved potato digger was developed based on early research as well as agrotechnical requirements poured into potato diggers (Fig.1).

The potato digger consists a frame 1 equipped with a suspension device, a main 2 and an intermediate coulter fixed to the frame, oscillating plows 3 attached to the main plows, and mechanisms that oscillate the plows. Oscillating motion to the tractor 3 is transmitted from the tractor power take-off shaft through a cardan shaft 4, a transmission box 5, a crankshaft 6, a drawbar 7, a bridle 8, a two-shouldered lever 9 and a lever 10. The technological process potato digger is as follows.

The main ploughshares 2 separate the soil layer from the bottom soil with the nodes, crush it and partially separate it from the main mass, and then direct it to the oscillating ferules 3. The harrows intensively separate the tubers from the soil and throw them on the surface field. The process separating potatoes from the soil and sieving the soil is improved under the influence oscillating feruls 3. The intermediate blade potato digger scoops up the potatoes that fall between the rows and transfers them to the harvesters.

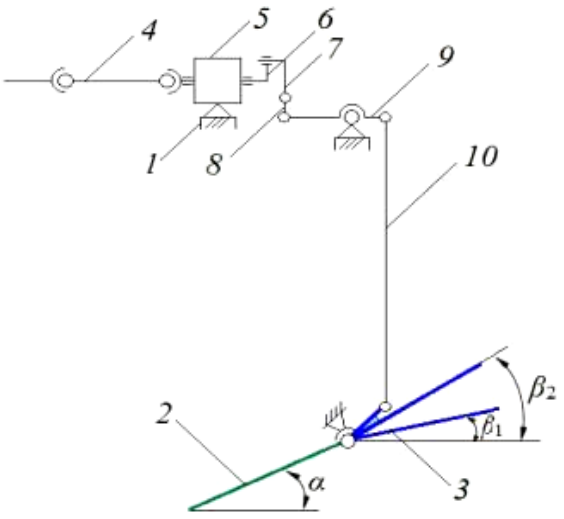


**Figure 1.** The scheme potato digger with a lattice ploughshare and oscillating rods: 1 – frame; 2 – ploughshare; 3 – rod; 4 – driveshaft; 5 – transmission; 6 – crankshaft; 7 – traction; 8 – leash; 9 – double–shoulder link; 10 – rod

Conducted studies on determining the angle deviation a plow relative to the horizon. According to their research, angle a should be between 22-30º. We take $\alpha$=22º.

It is known that the length of the ploughshare potato digger affects whether the nodular mass accumulates in front ploughshare. As the length ploughshare increases, the speed movement nodular mass along the surface ploughshare decreases, which, in turn, causes the soil to accumulate in front ploughshare and disrupt the technological process. Under the influence plow, the nodular mass should move freely and disintegrate sufficiently on its surface. The length ploughshare was determined. We determine by the following expression

$$L_l \le ctg(\alpha+\varphi)\left\{\frac{\sigma_b}{\rho_x g}-\frac{2V_M^2}{g}\sin\tau[\cos\pi tg(\alpha+\varphi)-\sin\tau]\right\}, \quad (1)$$

where $\sigma_b$ – is the temporary resistance to compression soil, Pa; $\rho_x$ – volume density of soil, kg/m$^3$; $\tau$ – is the soil refraction angle, º; $g$ – acceleration free fall, m/s$^2$; $V_M$ – movement speed, m/s.

**3. Results and discussion**

The results experimental studies are shown in Figures. According to the results obtained with an increase in the angle inclination lattice plowshare, losses and damage to potatoes first decrease, and then increase according to the law concave parabola.

The influence width lattice plowshare on the quality and energy indicators potato digger. To justify the width lattice ploughshare, lattice ploughshares with widths of 35, 45, 55 and 65 cm were experimentally developed and manufactured. According to the results experiments, with an increase in the width lattice plowshare, potato losses first decrease and then increase according to the law concave parabola. Damage to potatoes decreases with an increase in the width ploughshare. This is due to the fact that with smaller values width ploughshare, the tuberous mass is not completely covered by them and the tubers are damaged by the blades of the ploughshares.

**4. Conclusions**

The most optimal design scheme an improved potato digger is a system consisting of transmission mechanisms, lattice ploughshares and forcibly oscillating rods. Potato digger parameters are based on

As a result theoretical studies carried out, analytical dependencies and mathematical models were obtained that allow determining the parameters and operating mode an improved potato digger with lattice ploughshares and oscillating rods. To destroy the tuberous formation to the required extent with minimal energy consumption, the width lattice ploughshare should be 55 cm, the angle ploughshare installation relative to the horizon is 22 °, the length ploughshare 38 cm.

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# ANALYSIS OF A MODEL FOR ESTIMATION OF DELAYS IN ACCESS NETWORKS

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***ABSTRACT***

*The article presents an analysis of the model for assessing delays in access networks. A mathematical model for calculating the parameters of functioning of distributed data processing systems using wireless technologies with competing access is considered. Some methods used in the analysis of the model for assessing delays in subscriber access networks are presented, as well as an example of Maple 13 software for a numerical solution. The developed mathematical model helped to calculate the law of distribution of packet delivery time, to determine their parameters.*

***Keywords:*** *probability of collisions, decreases time delays, the limiting probabilities, graphs of the change in delivery, packet sending intensity.*

# АНАЛИЗ МОДЕЛИ ОЦЕНКИ ЗАДЕРЖЕК В СЕТЯХ ДОСТУПА

***АННОТАЦИЯ***

*В статье представлен анализ модели оценки задержек в сетях доступа. Рассмотрена математическая модель для расчета параметров функционирования систем распределенной обработки данных, использующих беспроводные технологии с конкурирующим доступом. Представлены не которые методы, используемые при анализе модели оценки задержек в сетях абонентского доступа, а также пример программного обеспечения Maple 13 для численного решения. Разработанная математическая модель помогла рассчитать закон распределения времени доставки пакетов, определять их параметры.*

***Ключевые слова:*** *вероятность коллизий, уменьшение временных задержек, предельные вероятности, графики изменения доставки, интенсивность отправки пакетов.*

## INTRODUCTION

As technologies develop and improve, the quality of information transmission improves, noise immunity increases, and time delays in the network decrease. Mathematical modeling of information transmission processes also contributes to solving these problems.

When transmitting data in wireless Wi-Fi networks, a distributed coordination function DCF is used, which uses the carrier sense multiple access with collision avoidance (CSMA/CA) method together with the binary exponential backoff algorithm. This method is used to organize equal access to the data transmission medium in IEEE 802.11 standards and allows for the possibility of errors in information transmission. The transmitting side does not receive an ACK frame about successful reception if the transmission was unsuccessful (due to station collisions or interference), and then the size of the contention window for the transmitting node after each unsuccessful attempt almost doubles according to formula 2, where n = 5,…,10 (for 802.11a). The maximum window size is 1023, 1021 slots. Thus, as the number of collisions increases, the window size increases dynamically, which reduces the probability of collisions and decreases time delays. The sequence of information exchange (for the 802.11a standard) in the case of successful transmission of one packet (fragment) is shown in Figure 1, and in the case of unsuccessful information transmission on the first attempt, but successful on the second - in Figure 2.

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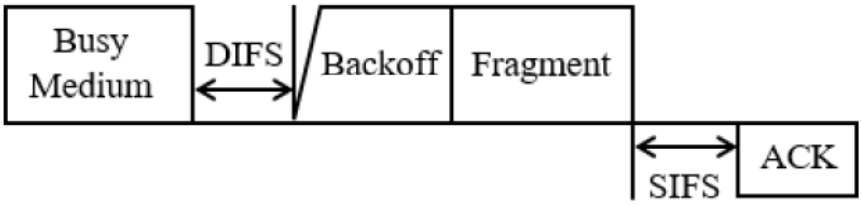


Fig. 1. Successful transmission of one fragment on the first attempt

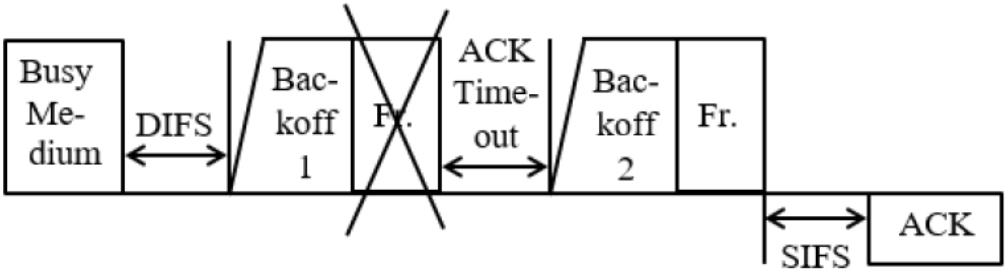


Fig. 2. Unsuccessful transmission of one fragment on the first attempt

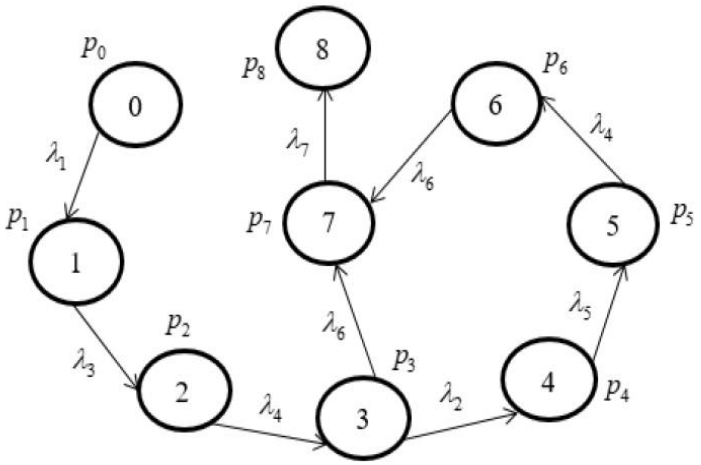


Fig. 3. State graph for possible unsuccessful transmission of one packet by one station with delay

Let us describe the states shown in Figure 3: $p_0$ is the initial state (there are no packets to send); $p_1$ is packet generation by the transmitting station; $p_2$ is pause 1 (the station waits for DIFS + Backoff Time_1); $p_3$ is the station sending a packet with a delay; $p_4$ is the station unsuccessfully transmitting some packets the first time; $p_5$ is pause 2 (the station waits for ACK-Timeout and Backoff Time-2); $p_6$ is successful transmission of "unsuccessful" packets, $p_7$ is the transmitting station waiting for SIFS; $p_8$ is the receiving station transmits an ACK acknowledgement packet with a delay [1,2]. Here $\lambda_i$ is the information transmission intensity, $\lambda_1$ packets/s is the information transmission intensity by the transmitting station, *k* is the unsuccessful sending coefficient (percentage of sent packets). The delay time takes the values 50, 75,100,125 of the delay t [μs].

## RESEARCH OBJECT AND METHODS

Solution method. To find the limiting probabilities of the system states and the law of distribution of the information transmission time, we construct a system of Kolmogorov equations corresponding to this graph:

$$\begin{cases} \frac{dp_0}{dt} = -\lambda_1 p_0, \\ \frac{dp_1}{dt} = \lambda_1 p_0 - \lambda_3 p_1, \\ \frac{dp_2}{dt} = \lambda_3 p_1 - \lambda_4 p_2, \\ \frac{dp_3}{dt} = \lambda_4 p_2 - \lambda_2 p_3 - \lambda_6 p_3, \\ \frac{dp_4}{dt} = \lambda_2 p_3 - \lambda_5 p_4, \\ \frac{dp_5}{dt} = \lambda_5 p_4 - \lambda_4 p_5, \\ \frac{dp_6}{dt} = \lambda_4 p_5 - \lambda_6 p_6, \\ \frac{dp_7}{dt} = \lambda_6 p_3 + \lambda_6 p_6 - \lambda_7 p_7, \\ \frac{dp_8}{dt} = \lambda_7 p_7 \end{cases}$$

with initial conditions:

$$\begin{cases} p_0(0)=1, \\ p_i(0)=0 \quad (i=1,\ldots,8). \end{cases}$$

For the numerical solution of system (1)-(2), the parameter values from the IEEE 802.11a standard were used: SLOT TIMER t = 16 μs, SIFS t = μs, DIFS SIFS SLOT TIMER t = 100 μs, ACK Timeout t = μs BACKOFF SLOT TIMER $t_d$ ($i_d$ is a random value of the Backoff Time timer, in this case $1_d$ = 31 , $2_d$ = 63), the ACK packet size is 14 bytes, the size of the transmitted FRAGMENT packet is 798 bytes (770 bytes plus 28 bytes of service information). Data transfer rate K is 100 Mbit/s. The solution to the system was found numerically on the segment [0;0.04] with the number of partition segments N = 2000 [3,4].

## RESEARCH RESULTS AND THEIR DISCUSSION

For the numerical solution, the Maple 13 software package and the Runge-Kutta Felberg method of 4-5 orders were used. The constructed mathematical model allows calculating the law of delivery time distribution and determining its parameters. For the coefficient of unsuccessful sending k = 0.1%, the influence of different values of the delay time t (50, 75,100,125) of the delay t on the information delivery time was estimated for different values of the packet sending intensity $\lambda_1$ ($\lambda_1$ varies from 200 to 10000 packets/s). Figure 4 shows the graphs of the change in delivery time for different values of $\lambda_1$ with changing values of the delay t. The nature of the curves is close to linear, and the curves are parallel. With increasing intensity, the delivery time decreases, and the higher the intensity, the closer the graphs are to each other [5,6].

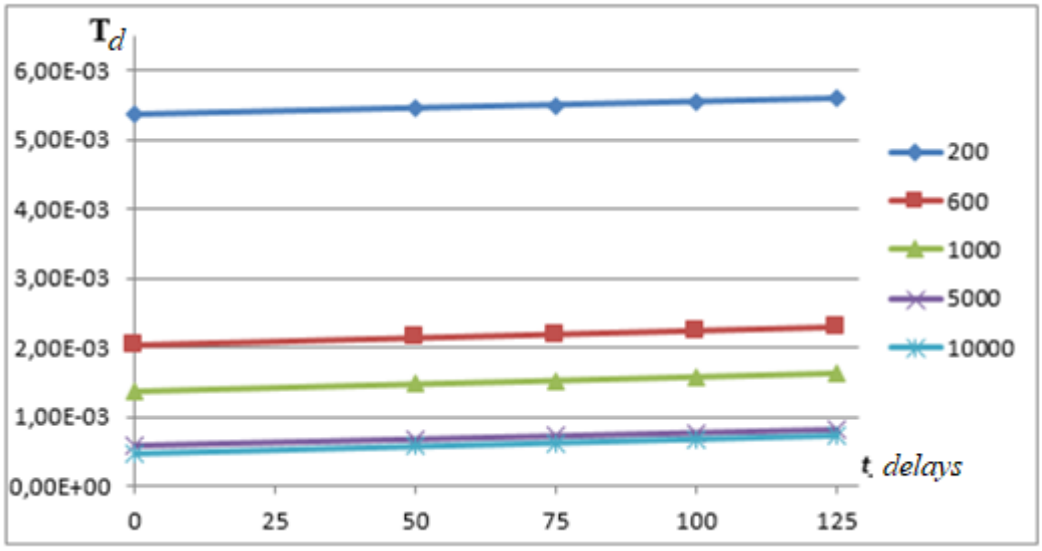


Fig. 4. Change in delivery time for different values of $\lambda_1$ with changing values of delay t

Figure 5 shows graphs of change in delivery time for a fixed value of delay t for changing values of $\lambda_1$, and shows an exponential decrease in delivery time with an increase in the intensity of sending packets, and for small values of $\lambda_1$ the time values are very close, and for large values they differ slightly, increasing with an increase in delay t.

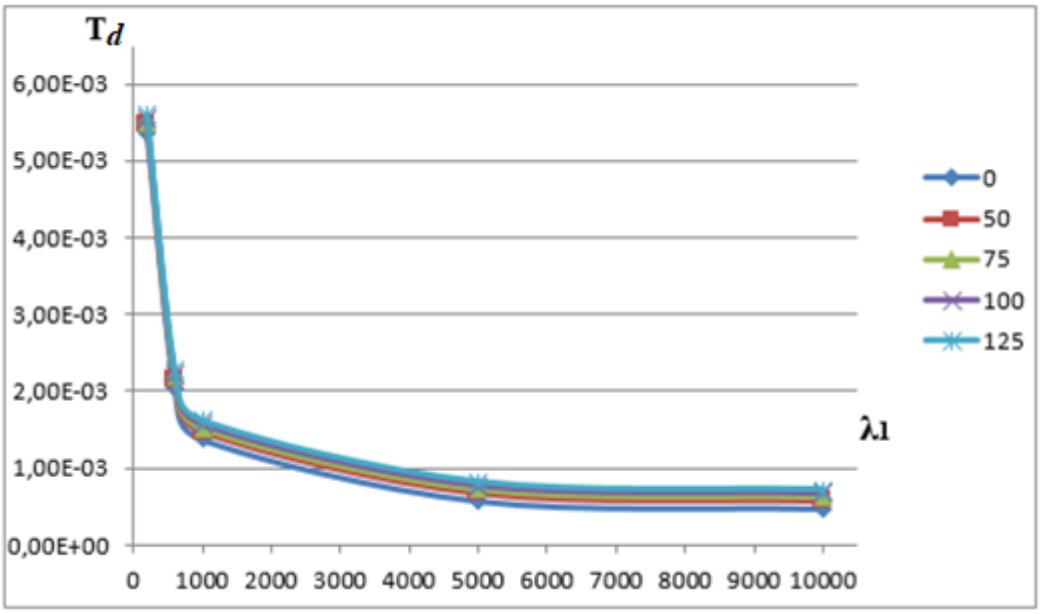


Fig. 5. Change in delivery time at a fixed delay value t for changing values of $\lambda_1$

Figure 6 shows graphs of changes in delivery time differences at fixed values of differences t=delay–0 for changing values of $\lambda_1$. The nature of the curves is practically constant. With an increase in the values of differences t=delay–0, the difference in delivery times increases.

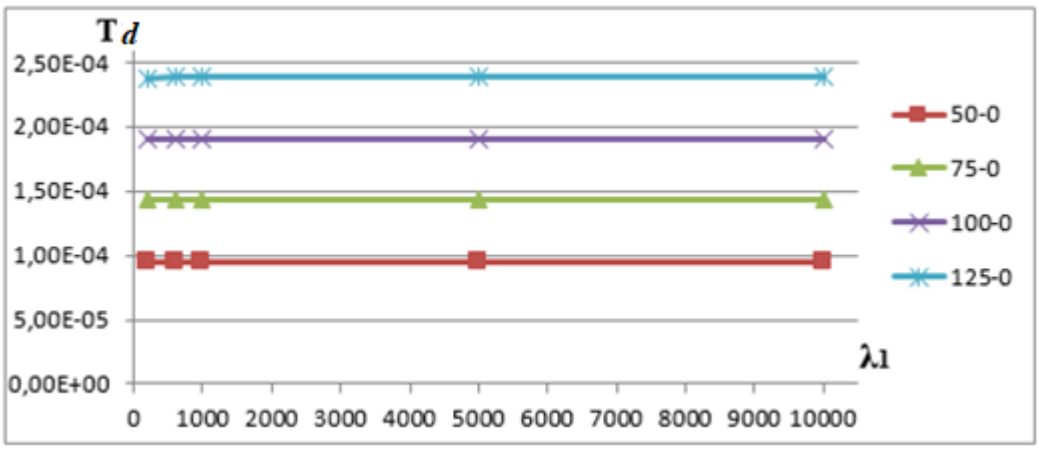


Fig. 6. Change in delivery time differences at fixed values of t=delay–0 differences for changing values of $\lambda_1$

## SCIENTIFIC RESEARCH RESULTS AND CONCLUSION

Figure 7 shows graphs of change in delivery time differences for different values of $\lambda_1$ at changing differences of 50, 75, 100, 125 delay values t = 0. The graphs practically merge with each other, and with an increase in the differences t=delay–0, the difference in delivery times increases linearly [7,8].

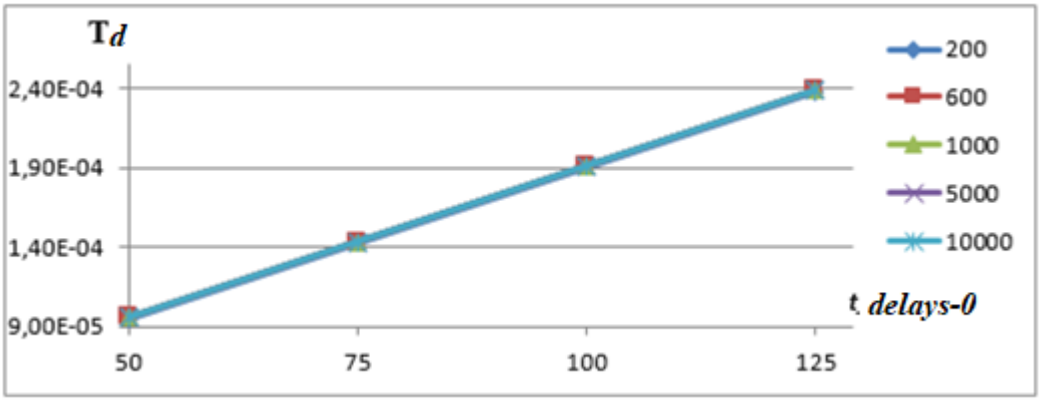


Fig. 7. Change in the differences in delivery times for different values of $\lambda_1$ with changing differences in the values of t delay = 0

## FINAL CONCLUSION

The constructed mathematical model provides for the possibility of an error occurring during the information transfer process on the first attempt and allows analyzing the operating modes of the Wi-Fi network when changing various parameters: packet generation intensity, data transfer rate, unsuccessful sending rate, delay time. This model can be useful both in designing wireless sections of a distributed information processing network and in their modernization. The model allows estimating and investigating the delivery time of one packet by one station depending on various parameters: delay time, unsuccessful sending rate, packet sending intensity, data transfer rate, etc. The packet exchange process is considered to be homogeneous Markov with discrete states and continuous time. To find the marginal probabilities of the system states and the law of distribution of the information transfer time, a marked state graph and the corresponding system of Kolmogorov equations are constructed. The results of calculating the change in the packet delivery time depending on various parameters are presented. This model can be useful both in designing wireless sections of a distributed information processing network and in upgrading them. Keywords: Wi-Fi, CSMA/CA, WLAN, MAC, data transmission modeling, delay, interference, throughput, medium access protocol.

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# MAHALLIY SABZI NAVLARI ASOSIDA TAYYORLANGAN PYURENING KIMYOVIY VA BAKTERIOLOGIK TAHLILI

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***Annotatsiya.*** *Sabzavotlarning yo‘qotilishini kamaytirish va sifatini oshirishning muhim usullaridan biri ishlab chiqarishga zamonaviy texnologik asbob-uskunalarni keng joriy etish hisoblanadi. Konservalash - oziq-ovqat mahsulotlarini saqlash uchun ishlatiladigan jarayon bo'lib, mahsulotda o'sishi va uning buzilishiga olib keladigan mikroorganizmlarni yo'q qilishdan iborat. Konservalangan sabzi pyuresining tarkibida mezofil, spora hosil qilmaydigan mikroorganizmlar, achitqilar va zamburug’lar aniqlanmadi. Konserogen toksik elementlar ruxsat e’tilgan me’yor darajasidan pastligi aniqlandi.*

***Kalit so‘z:*** *sabzi pyuresi, Mirzoi sariq-304, sterilizatsiya, pestisidlar, radiologik element.*

## KIRISH

Bugungi kunda qishloq xo’jaligining samaradorligini oshirish va aholini oziq-ovqat mahsulotlari bilan uzluksiz ta’minlash dolzarb masala sanaladi. Aholini yil davomida meva-sabzavot va poliz mahsulotlari bilan ta’minlash uchun saqlash va qayta ishlash ishlariga alohida e’tibor qaratish lozim.

Meva – sabzavot va poliz mahsulotlarini yetishtirish,yig‘ish, tashish, saqlash va qayta ishlash ilmiy tashkil qilinsa, bu borada fan-texnika yutuqlari hamda ilg‘orlar tajribasi keng joriy etilsa, mahsulotlar isrof bo‘lishi kamayadi. Chunki har yili yetishtirilgan hosilning 20-30 % i yig‘ish, tashish va saqlash jarayonida nobud bo‘ladi [1].

Sabzi (Daucus) soyabonguldoshlar oilasiga mansub bo’lib, ikki va bir yillik o‘tsimon o‘simliklar turkumi, sabzavot ekini sanaladi. Sabzining 60 dan ortiq turi mavjud. Jahondagi deyarli barcha mamlakatlarda karotinli navlari yetishtiriladi.

Dehqonchilikda mil. av. 2ming yillikdan ma’lum. Xitoy, Fransiya, Italiya, Rossiya va boshqa mamlakatlarda ko‘p ekiladi. Jahon bo‘yicha sabzi ekin maydoni 861 ming ga, yalpi hosili 18,4 mln. t, hosildorligi 214,3 s/ga ni tashkil qiladi. Ildizmevasi sersuv, naviga qarab dumaloqroq, silindrsimon, rangi sariq, oq va ba’zan qizg‘ish, och qizil, uzunligi 8-17 sm, vazni 30-200 g va undan ortiq. Sabzi (ildizmevasi)da 10-12 % qand, 9,2% uglevodlar, 1,1 % azotli moddalar va C, B,, B2, PP vitaminlari, 9,0 (20-25 gacha) mg % karotin bor. Sabzi inson oziq-ovqat ratsionida muhim o‘rinda turadi. Xashaki navlarining ildizmevasi rangi oq, asosan, chorvachilikda ozuqa sifatida ishlatiladi. 100 kg ildizmevasida 14 ozuqa birligi, 0,8 kg hazm bo‘luvchi protein, 80 g kalsiy, 50 g fosfor bor. Sabzi oziq-ovqat va shirali ozuqa sifatida, shuningdek, boshqa mahsulotlar olishda xom ashyo sifatida ishlatiladi. Yangiligida iste’mol qilinadi, konservalar, tibbiyotda esa sabzidan turli doridarmonlar tayyorlanadi. O‘zbekistonda xalq seleksiyasida sabzining juda ko‘p navlari yaratilgan. Hozirgi davrda sabzining Mushak 195 (ertapishar) va Nurli (o‘rtapishar), Mirzoi qizil 228, Mirzoy sariq 304 (o‘rta ertagi), Nant 4, Shantane 2461 (o‘rtagi) va Ziynatli, Kaskade G, Puma G va boshqa navlari va duragaylari ekiladi[2].

Sabzavotlarning yo‘qotilishini kamaytirish va sifatini oshirishning muhim usullaridan biri ishlab chiqarishga zamonaviy texnologik asbob-uskunalarni keng joriy etish hisoblanadi. Konservalash - oziq-ovqat mahsulotlarini saqlash uchun ishlatiladigan jarayon bo'lib, mahsulotda o'sishi va uning buzilishiga olib keladigan mikroorganizmlarni yo'q qilishdan iborat. Konserva ishlab chiqarishning zamonaviy usullari asosan o'z xususiyatlarini va ozuqaviy qiymatini saqlaydigan, ba'zi hollarda esa biologik faol moddalar bilan boyitilgan mahsulotlarni yaratishga imkon beradi[3].

Sabzi tarkibida oqsillar-1,3 % gacha, uglevodlar, jumladan saxaroza-7 % gacha, kraxmal- 0,2 % gacha, pektin moddalari- 1 % gacha, ozuqaviy tolalar- 1,5 % gacha, makro va mikroelementlar-1 % gacha va karotenoidlar-14 mg % gacha mavjud. Sabzi tarkibidagi uglevodlar miqdori o‘rtacha 4-7 % ni tashkil qiladi, asosan glyukoza va fruktoza ko‘p, saxaroza esa 15 mg% dan oshmaydi[4].

Olingan hosilni saqlash va undan oqilona foydalanish, xomashyodan maksimal miqdorda mahsulot olish bugungi kunda dolzarb masala hisoblanadi. Qishloq xo‘jaligida ishlab chiqarish mavsumiyligi tufayli, qishloq xo‘jaligi mahsulotlarini turli ehtiyojlar uchun foydalanish uchun bir yil va undan ortiq muddatga saqlash zarurati tug‘iladi. Sabzini saqlash ko'pincha yig'ish vaqti va usuliga bog'liq. Xorazm viloyatida sabzi yig'ish uchun optimal vaqt 20 sentabrdan 10 oktabrgacha[5].

Konservalash - oziq-ovqat mahsulotlarini saqlash uchun ishlatiladigan jara-yon bo‘lib, mahsulotda o‘sishi va uning buzilishiga olib keladigan mikroorganizmlarni yo‘q qilishdan iborat. Konserva ishlab chiqarishning zamonaviy usullari ko‘p jihatdan o‘z xususiyatlarini va ozuqaviy qiymatini saqlaydigan va ba’zi hollarda biologik faol

moddalar (vitaminlar, mineral tuzlar va boshqalar) bilan boyitilgan mahsulotlarni yaratishga imkon beradi. Oziq-ovqat mahsulotlarining sifatini saqlab qolgan holda saqlash muddatini oshirish oziq-ovqat texnologiyasi sohasidagi mutaxassislar va olimlar hal qiladigan asosiy vazifalardan biridir. Saqlash vaqtida turli xil oksidlanish jarayonlari sodir bo'lishi mumkin, bu birinchi navbatda mahsulot tarkibidagi lipidlarga ta'sir qiladi. Sabzavotlarning o‘ziga xos xususiyati shundaki, ular meva va rezavorlarga qaraganda sirtda sezilarli darajada ko'proq mikroorganizmlar yashaydi. O‘sish davrida tuproq bilan bevosita aloqa qiladigan sabzavotlar yuzasida undan ham ko‘proq mikroorganizmlar mavjud. Sabzavotlarni konservalashning asosiy texnologik bosqichlaridan biri – steri-lizatsiya hisoblanadi. Aynan shu narsa iste’molchi uchun mahsulotning ozuqaviy qiymatini, organoleptik xususiyatlarini, xavfsizligini belgilaydi va konservalangan mahsulotlarning sifatini yaxshi va uzoq muddatli saqlash uchun zarur shart-sharoitlarni yaratadi. Binobarin, biologiya, fizika va kimyo fanlarining ilmiy asoslangan tamoyillari va qonuniyatlari asosida ishlab chiqilgan sterilizatsiya jarayonini to‘g‘ri yo‘lga qo‘yish bilangina konserva mahsulotlari sifatini tubdan yaxshilashning eng muhim zamonaviy vazifasini hal etish mumkin. Xuddi shu tamoyillar va qonunlar oziq-ovqat mahsulotlarini saqlashning yakuniy bosqichini kuchaytiradigan eng samarali texnik vositalarni ishlab chiqish va tanlashning to'g'riligini belgilaydi. Issiqlik bilan sterilizatsiya qilish meva va sabzavotlarni konservalashning asosiy usuli hisoblanadi. Bu mikroflorani yo'q qilish va yuqori harorat ta'sirida mahsulotdagi biokimyoviy o'zgarishlarni to'xtatishga asoslangan[3-4].

## METODIK QISM

Tajribalar uchun Mirzoi sariq-304 navli sabzidan foydalanildi. Sabzining tarkibi quyidagi 1- jadvalda keltirilgan.

**1-jadval**

**100 gr sabzining kimyoviy tarkibi**

| № | Ko‘rsatkich nomi | Qiymati |
|---|---|---|
| 1 | Energetik qiymati | 35 kkal |
| 2 | Oqsillar | 1,3 gr |
| 3 | Yog‘lar | 0,1 gr |
| 4 | Uglevodlar | 6,9 gr |
| 5 | Suv | 88 gr |
| 6 | Organik kislotalar | 0,3 gr |

Mirzoi sariq-304 navli sabzi navli sabzi olma bilan birga pyure qilindi. Olingan mahsulot mikrobilogik tahlillardan o’tkazildi.

Mahsulot tarkibidagi qoldiq pestisidlar miqdori GOST 32689.2-2014 asosida aniqlandi.

Sterilizatsiya qilingan sabzi pyuresining bakteriologik tahlillari GOST 30425-97 talablari asosida amalga oshirildi.

Tarkibdagi og'ir metallar atom-absorbsion spektrometr AURORA AI 1200 qurilmasidan foydalanildi. Qurilma ishlab chiqaruvchisi Aurora Instruments Ltd, Yaponiya.

Radiologik elementlar O'z OU 07.0547-2011 asosida aniqlandi.

## NATIJALAR VA ULARNING MUHOKAMASI

Sabzi va olma asosli pyure mikrobilogik tahlillardan o'tkazildi. Pyure tarkibidagi qoldiq pestisidlar miqdori aniqlandi. Sinov natijalari quyidagi 2-jadvalda keltirilgan.

**2-jadval**

**Sabzi pyuresining tarkibidagi qoldiq pestisidlar**

| № | Ko'rsatkichlarning nomi (o'lchov birligi) | Sinov metodi uchun me'yoriy xujjat | Ruxsat e'tilgan me'yor | Namunada | Natijaning me'-yoriy xujjatga muvo-fiqligi bo'yicha xulosa |
|---|---|---|---|---|---|
| 1 | Geksoxloran va uning izomerlari, mg/kg | MU 012-3-0010-30.12.2003 yil | 0,5 | topilmadi <0,005 | mos |
| 2 | Insektisid va uning metobolitlar, mg/kg | | 0,1 | topilmadi <0,005 | mos |

Pestisid qoldiqlarini aniqlashda na'munalar 20 $^{o}$C haroratda, 40 % namlikda olindi. Normativ hujjatlar bo'yicha geksoxloran va uning izomerlari uchun ruxsat etilgan me'yor 0,5 mg/kg ni tashkil qiladi. Olingan natijalarga ko'ra bu qiymat sabzi pyuresida 0,005 mg/kg dan kam ekanligi aniqlandi. Insektisid va uning metobolitlari miqdori ruhsat e'tilgan me'yor bo'yicha 0,1 mg/kg ni tashkil qiladi. Sinov tahlillari asosida insektisid va uning metobolitlari miqdori namunada 0,005 mg/kg dan kam ekanligi aniqlandi.

Namunalar bakteriologik tahlillardan o'tkazildi. Tahlil uchun olingan namunalar 20 $^{o}$C haroratda, 40 % namlikda olindi. Sinov natijalari 3-jadvalda keltirilgan.

**3-jadval**

**Sabzi pyuresining bakteriologik tahlillari**

| № | Ko‘rsatkichlarning nomi (o‘lchov birligi) | Sinov metodi uchun me’yoriy xujjat | Ruxsat e’tilgan me’yor | Namunada | Natijaning me’yoriy xujjatga muvofiqligi bo‘yicha xulosa |
|---|---|---|---|---|---|
| 1 | Mezofil klosrtiriydlar 1 gr ($sm^3$) da | GOST 30425-97 b.7.7 | Ruxsat etilmaydi | aniqlanmadi | mos |
| 2 | Spora hosil qilmaydigan mikroorganizmlar 1 gr ($sm^3$) da | GOST 30425-97 b.7.7 | Ruxsat etilmaydi | aniqlanmadi | mos |
| 3 | Achitqilar KXQB 1 gr ($sm^3$) da | GOST 30425-97 b.7.8 | Ruxsat etilmaydi | aniqlanmadi | mos |
| 4 | Zamburug’lar KXQB 1 gr ($sm^3$) da | GOST 30425-97 b.7.8 | Ruxsat etilmaydi | aniqlanmadi | mos |

O‘tkazilgan bakteriologik tahlillar asosida shu narsa ma’lum bo‘ldiki pyure tarkibidagi mezofil, spora hosil qilmaydigan mikroorganizmlar, achitqilar va zamburug’lar ruxsat etilgan me’yor talabiga mos ekanligi aniqlandi.

Og'ir metallar yer yuzida tabiiy ravishda uchraydigan elementlar hisoblanadi. Ularning juda oz qismi oziq-ovqat, ichimlik suvi va havo orqali inson tanasiga kirishi mumkin. Ulardan ba’zilari, mis, rux va selen kabi metallar inson organizmidagi metabolizm uchun juda muhimdir. Ammo ularning inson tanasida katta miqdordagi mavjudligi xavfli va ular toksik yoki kanserogen bo‘lishi mumkin. Shu sababdan sabzi pyuresi tarkibidagi og‘ir metallar miqdori aniqlandi. Natijalar 4-jadvalda keltirilgan.

**4-jadval**

**Sabzi pyuresi tarkibidagi og‘ir metallar**

| № | Ko‘rsatkichlarning nomi (o‘lchov birligi) | Sinov metodi uchun me’yoriy xujjat | Metodika noaniqligi | Ruxsat e’tilgan me’yor | Namunada | Natijaning me’yoriy xujjatga muvofiqligi bo‘yicha xulosa |
|---|---|---|---|---|---|---|
| 1 | Qo’rg’oshin, mg/kg | GOST 31262-2004 | 0,051 | 0,5 | topilmadi <0,04 | mos |
| 2 | Mishyak, mg/kg | GOST 26930-86 | 0,027 | 0,2 | topilmadi <0,005 | mos |
| 3 | Kadmiy, mg/kg | GOST 31262-2004 | 0,051 | 0,03 | topilmadi <0,05 | mos |
| 4 | Simob, mg/kg | GOST 26927-86 | 0,0278 | 0,02 | topilmadi <0,015 | mos |
| 5 | Mis, mg/kg | GOST 31262-2004 | 0,0512 | 5,0 | topilmadi <0,05 | mos |
| 6 | Rux, mg/kg | GOST 31262-2004 | 0,124 | 10,0 | topilmadi <1,0 | mos |

O‘tkazilgan laborotoriya sinov natijalari tahlillari asosida shu narsa ma’lum bo‘ldiki, mahsulot tarkibidagi toksik kanserogen elementlar miqdori inson iste’moli uchun ruhsat etilgan me’yor darajasida.

## XULOSA

Sabzvotlarni konservalash mahsulotda o'sishi va uning buzilishiga olib keladigan mikroorganizmlarni yo‘q qilishdan iborat jarayon hisoblanadi. O‘tkazilgan tadqiqotlar natijasida konservalangan sabzi pyuresining tarkibida mezofil, spora hosil qilmaydigan mikroorganizmlar, achitqilar va zamburug’lar aniqlanmadi. Konserogen toksik elementlar ruxsat e’tilgan me’yor darajasidan pastligi aniqlandi.

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# ANALYSIS OF PERFORMANCE TESTING OF IaaS CLOUD INFRASTRUCTURES

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***ABSTRACT***

*The article presents an analysis of IaaS cloud infrastructure performance testing. It shows how to properly test a cloud before deploying the infrastructure. The main difficulties in cloud testing are considered. Effective tools used in testing and problems that arise during cloud testing are presented.*

***Keywords:*** *infrastructure as a Service (IaaS), scenarios for using IaaS, performance of a classic software system, SOASTA CloudTest, Load Impact, Blaze Meter, Smart Bear Load Complete.*

# АНАЛИЗ ТЕСТИРОВАНИЯ ПРОИЗВОДИТЕЛЬНОСТИ ОБЛАЧНЫХ ИНФРАСТРУКТУР IaaS

***АННОТАЦИЯ***

*В статье представлен анализ тестирования производительности облачных инфраструктур IaaS. Показано как правильно тестировать облако перед размещением инфраструктуры. Рассматриваются основные сложности при тестировании облака. Представлены эффективные инструменты, используемые при тестировании, проблемы возникающие при тестировании облака.*

***Ключевые слова:*** *инфраструктура как услуга (IaaS), сценарии использования IaaS, производительность классической программной системы, SOASTA CloudTest, Load Impact, Blaze Meter, Smart Bear Load Complete.*

## INTRODUCTION

Infrastructure as a Service is a more complex service model. It involves leasing the computing resources a company needs on a subscription basis. Instead of purchasing expensive equipment that requires maintenance and is prone to rapid obsolescence, a company can use the computing resources it needs directly from the cloud. As part of the IaaS service, the client leases virtual servers (VPS or VDS), a network infrastructure that ensures their connection with each other and with the company, as well as protection of the communication channel using VPN, a load balancer, and, finally, access to an administrative panel in which you can manage access and user rights, as well as scale the capacities that are included in the subscription package. Along with the infrastructure, you can request related services from the provider: cloud data storage with fast access and a volume that can be increased as needed, as well as a data backup service [1].

## RESEARCH OBJECT AND METHODS

There are many scenarios for using IaaS. Cloud infrastructure is relevant for those companies that, for whatever reason, do not want to maintain their own computing power or even want to get rid of it. Such a desire will allow you not to develop additional competencies that are not typical for the company's core business (infrastructure requires support and development), save on purchasing equipment and arranging premises, and optimizing staff. IaaS will come in handy when you need to quickly launch a business or a new project, with a lack of funds for capital investments, in cases where a sharp increase in the volume of computing power is needed (here we can recall the same seasonality that many companies and even industries face).

For example, seasonality is typical for many companies in the e-commerce segment, especially if they specialize in selling specific groups of goods. Online stores for construction or gardening experience peak loads in the warm months, clothing and footwear sellers - in the spring and autumn.

Finally, the entire e-commerce segment experiences a colossal load during sales. Very often, it is necessary to sharply increase the performance of your systems for literally several months or even weeks, and then return to normal consumption volumes. The IaaS service, which can be obtained from Rusonyx, is the optimal solution for such enterprises. Launching additional servers, increasing their performance, expanding access to the infrastructure for temporary personnel - all this is available from the Rusonyx client control panel. The administrator will only need to move a few sliders to get everything they need in a few minutes. In this case, you can select the required number of processors used by the servers, the amount of memory, and the operating system, and the drives used. When talking about a cloud structure

built on the IaaS model (infrastructure as a service), they do not mean a separate cloud server - a virtual machine instead of a physical one - but an interconnected pool of IT resources deployed on rented capacities. When choosing a cloud for hosting infrastructure, users often ask for a "test drive" to evaluate the ease of use and resource performance. Many, even experienced specialists, have a simplified idea of the testing process, so they limit themselves to running a set of synthetic or working tests. Similar tests are used for desktop computers. In practice, such researchers face difficulties due to the relative novelty of cloud technologies and the differences between virtual machines and "hardware" servers. Even experienced IT specialists often lack the knowledge and experience in testing cloud resources, and there are no generally accepted standards [2].

Here is the main reason: the performance of a classic software system is assessed under a certain workload for a fixed configuration. But it is impossible to ensure a stable load and resource configuration in a public cloud. To adapt to changing tenant conditions, providers automatically allocate and release resources "on the fly".

Instead of measuring the average performance of a static system under maximum load, it is more logical to evaluate other characteristics. For example, the ability of cloud services to adapt to changing loads in terms of performance and costs. An additional metric should cover the reliability of these services in the event of individual node failures, as well as in the event of a complete data center shutdown. This problem arises when it is necessary to compare the obtained results. Different providers offer services that do not match in content: with different capabilities; with different guarantees; with its service parameters specified in the SLA agreement.

What is important to remember before testing: distributed computing technologies are developing rapidly and there are many incompatible implementations; the cloud IaaS market is young and is in the development and experimental stage; the user does not have direct contact with the equipment, so he interacts with the rented resources remotely, through a web interface; professional software packages for testing are quite expensive [3].

## RESEARCH RESULTS AND THEIR DISCUSSION

Can "hardware" tests be applied to the cloud? To evaluate the performance of a desktop computer, several sets of tests are used - separately for the central and graphic processors, RAM and disk memory, network adapters. The test results of the latest processors and video cards become the subject of discussions on the Internet. The skepticism that such tests cause is quite justified. The equipment is often switched to a mode that is not used for daily work in order to get record results. Before testing, processors and memory are often "overclocked" with additional cooling, risky

experiments with fine BIOS settings, beta versions of device drivers, etc. The winners may be pleased with the numbers they receive, but they are unlikely to be able to continue working stably with such hardware and software settings. As for the virtual environment, it is impossible to “overclock” the components there.

The operating principle of a VM differs significantly from that of physical hardware that users are accustomed to. If the processor core of a physical computer is uniquely localized on the CPU crystal, then in IaaS it is an imitation of a quota allocated from the total capacity of the cloud. This virtual quota is created using a hypervisor. Each user is provided with an ordered volume of resources, but the actual state and status of the cloud infrastructure is constantly changing: when adding and removing running “instances” - abstractions of runtime environments, virtual machines; after starting and stopping running applications; due to fluctuations in user load; during backups, data recovery [4].

**Differences in the structure of the physical CPU and virtual machine**

Thus, there is a high probability that when re-running the same test at different times, the results will not be identical. The answer to the question of the applicability of tests for physical equipment to cloud infrastructures can be as follows: it is possible to apply “hardware” tests to the cloud, but the practical benefit from this is small.

How to test cloud infrastructures? Basic tests for clouds should take into account the modern specifics of distributed computing and remote user work on resources that are provided on demand in automatic mode, with the ability to scale in both directions.

## SCIENTIFIC RESEARCH RESULTS AND CONCLUSION

Testing the performance of individual subsystems (processors, memory, disks) for a comprehensive assessment of the cloud is clearly not enough, unlike similar tests of desktop computers. But they are still used for the very initial check of IaaS performance.

Economic feasibility for business is one of the main factors that stimulate the development of cloud computing. This includes service availability, stable operation under load fluctuations, security, backup and much more. These aspects are not always assessed by performance figures, but affect the comfortable and predictable use of the service by the user. Thus, you should not limit yourself to formal testing using even the most powerful software. A minimal (and sufficient, in most cases) testing scenario before starting work may look like this: measuring the performance of virtual machines in the cloud; testing the speed of data transfer between infrastructure nodes; checking the availability and scalability, elasticity of the cloud service at different times of the day; testing the functionality of backup and data recovery; assessing the response time of the provider's technical support to the request. For professional research and

assessment of the performance of cloud resources, you can use this test software: SPEC Cloud (TM) IaaS 2016 Benchmark; Hewlett Packard Enterprise StormRunner Load; LoadStorm; SOASTA CloudTest; LoadImpact; BlazeMeter; SmartBear LoadComplete; Spirent Blitz; SendGrid Loader.

These and similar packages require serious preparation and high user qualifications to use. This software is available by subscription or for a one-time fee; however, some of the listed packages are offered in a demo version with a limited validity period and limited capabilities [5, 6].

In any case, it is necessary to have a well-thought-out plan - a scenario for preparing and launching measurements, collecting and obtaining results (benchmarks). In this case, the concept of SUT (System Under Test) is used - a set of mandatory components for launching a measurement scenario. This set includes those cloud components whose parameters are of interest to the user and all the others, the functionality of which cannot be avoided during testing and whose parameters must be known in advance. In addition, the software package contains drivers that simulate the workload for the IaaS infrastructure being tested.

## FINAL CONCLUSION

For cloud testing, it is worth using specialized tests, rather than using "hardware" ones due to significant differences in the principles of their operation. The best way to evaluate the capabilities of the cloud infrastructure is to use tests that simulate the real operation of systems. Moreover, it is not enough to evaluate the performance of the components. There are other factors that affect the efficiency of work in the cloud that cannot be assessed using hardware testing. These factors include the response time of the provider's support, fault tolerance, data protection, etc. When preparing for testing, discuss this with the provider's technical support. This way, you will receive qualified advice in advance, and avoid misunderstandings due to the incompatibility of the hardware resources or the provider's virtualization system with the test software package selected for the project.

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