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АМЕРИКАНО-КИТАЙСЬКІ ВІДНОСИНИ ТА ВІЙНА У В'ЄТНАМІ У 1963–1968 РР.

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US-CHINESE RELATIONS AND THE VIETNAM WAR IN 1963–1968

Анотація.
У статті досліджено роль та місце війни у В'єтнамі в американо-китайських відносинах у 1963–1968 рр. Охарактеризовані причини, хід та наслідки активізації зовнішньополітичної стратегії адміністрації президента США Ліндона Джонсона у китайському напрямку протягом періоду, що вивчається. Досліджено практичну реалізацію Вашингтоном доктрини «стримування Китаю» та влив війни у В'єтнамі на політику США щодо КНР у 1963–1968 рр.

Abstract.
The article investigates the role and place of the Vietnam War in US-China relations in 1963-1968. There are described the reasons, course and consequences of the intensification of the foreign policy strategy by administration of the President of the United States of America Lyndon Johnson in the Chinese direction during the period under research. The practical implementation of the doctrine of "Chinese deterrence" by Washington and the impact of the Vietnam War on the USA policy towards China in 1963-1968 have been studied.

Ключові слова: *США, КНР, В'єтнам, американо-китайські відносини, Ліндон Джонсон.*
Keywords: *the USA, PRC, Vietnam, American-Chinese relations, Lyndon Johnson.*

Війна у В'єтнамі була однією з головних проблем адміністрації президента Ліндона Джонсона та відволікала увагу від китайської проблеми. Будь-які ініціативи щодо «пом'якшення» жорсткої лінії стосовно КНР, що виходили знизу, в тому числі з академічних кіл, не знаходили підтримки в урядових сферах і блокувалися ними. Архітектори американської політики щодо Китаю віддавали перевагу колишнім зовнішньополітичним установкам, в основі яких було уявлення про КНР як про невід'ємну частину соціалістичної співдружності [1, с. 22]. Тайбей став важливою ланкою в периметрі «антикомуністичної оборони» в АТР [12, с. 97]. Крім того, під час війни у В'єтнамі Пекін намагався не загострювати ситуацію в Тайванській протоці, що пояснювалося його небажанням отримати «другий фронт» в умовах наростаючої конфронтації з СРСР [18; 5, с. 282].

Приймаючи рішення про розширення збройного втручання США в Індокитай, президент Л. Джонсон не міг не враховувати в якості одного з головних чинників антирадянську орієнтацію КНР, яка істотно обмежувала можливості співпраці китайських керівників з СРСР та іншими соціалістичними країнами в плані спільної відсічі американській експансії. Крім того, на думку Г. Кіссінджера, антикитайський фактор зіграв важливу роль у рішенні Л. Джонсона почати війну у В'єтнамі [10, с. 208].

З метою посилення збройного втручання у війну в Індокитаї у 1964 р. Конгрес США затвердив Тонкінську резолюцію, яка дозволяла президентові «вживати всіх необхідних заходів для відображення будь-якого нападу на збройні сили Сполучених Штатів» [9, с. 136], що не викликало заперечень з боку Пекіна. Навпаки, він відкрито прагнув зменшити значення американської ескалації війни і агресивних дій проти ДРВ [7, с. 143].

У 1965 р. тривали зустрічі американського та китайського послів у Варшаві, однією з тем переговорів у ході яких була війна у В'єтнамі. В результаті цих зустрічей було досягнуто угоди, згідно з якою Китай надавав США свободу дій у Південному В'єтнамі [7, с. 142-144].

У наступні роки під час «культурної революції» китайські керівники не приховували бажання покінчити з війною у В'єтнамі. Коли в 1968 р. у Парижі почалися американо-в'єтнамські переговори, в Китаї про них зовсім не згадували, або давали зрозуміти, що не можна вірити в їх успіх [2, с. 104].

Необхідно відзначити, в середині 60-х рр. XX ст. в урядових колах США не знімали з порядку денного питання про необхідність «боротьби з комуністичною агресією», уособленням якої в Азії був і Китай. Представники американського істеблішменту розуміли, що їх відхід з Південно-Східної Азії неминуче надасть Китаю можливість використати шанси для поширення свого впливу на цю частину континенту [2, с. 104].

Крім того, в цей час Білий Дім почав схилятися до думки про самостійність КНР на міжнародній арені. Важливим фактором, який призвів до зростання ролі Пекіну в системі зовнішньополітичних пріоритетів Вашингтону, було випробування Китаєм ядерної бомби в 1964 р. Унаслідок цього, вже у другій половині 60-х рр. XX ст. значна частина американських правлячих кіл розглядала КНР як потенційно небезпечного ворога, як «новий центр революційного комунізму і джерело згубної зарази». Крім того, одним з лозунгів В'єтнамської війни була теза про «стримування Китаю» [3, с. 318; 4, с. 124; 15, с. 282].

Саме тому політика «стримування» КНР тривала, незважаючи на заклики китайських високопосадовців до мирного співіснування [7, с. 560-561]. Однак заклики Пекіна мали суто декларативний характер і були ідеологічним компонентом китайської зовнішньої політики. Насправді, все залишалося як і раніше, оскільки тенденція до послаблення напруженості в американо-китайських відносинах не могла бути реалізована внаслідок не готовності обох країн до суттєвих змін своєї позиції щодо одна одної [1, с. 13].

У цьому контексті показовим фактом є промова заступника державного секретаря в справах Далекого Сходу М. Банді 12 лютого 1966 р. в якій він відзначив, що США розглядає Китай як силу, яка кидає виклик американським інтересам: «Зовнішньополітичні цілі Пекіна і тактика, до якої він вдається для досягнення цілей, гостро ставлять перед нами проблему війни і миру в Азії, а також проблему свободи і життя мільйонів людей не тільки в Азії, але і у всьому світі». Він також зазначав, що Вашингтон не може погодитися з пануванням континентального Китаю в Азії і що США є «великим ворогом Пекіна» [6, с. 29].

Незважаючи на це, в середині 60-х рр. XX ст. у США все частіше почали лунати голоси стосовно перегляду політики щодо КНР у бік її поліпшення. Все більше уваги поліпшенню американо-китайських відносин почали приділяти в Конгресі, особливо внаслідок зростання антирадянських тенденцій у політиці КНР. Під час слухань у середині 60-х рр. мова йшла про те, як змінити політику Вашингтону щодо КНР з урахуванням радянсько-китайських розбіжностей. Цьому також сприяла кампанія, що розгорнулася в позаурядових колах, перш за все, в середовищі університетський професури, метою якої був перегляд зовнішньополітичного підходу до Китаю [2, с. 104].

Нестабільність всередині американського суспільства в зв'язку з війною у В'єтнамі, посилення боротьби національно-визвольних сил у різних частинах світу і цілий ряд інших факторів поставили питання про необхідність розробки нового курсу, який мав би забезпечити збереження світового лідерства США при мінімальних витратах матеріальних і людських ресурсів з їх боку [2, с. 111].

Завдання формування нового підходу щодо КНР гостро ще в 1967 р. оприлюднив кандидат в президенти від республіканської партії Р. Ніксон у своїй програмній статті «Азія після В'єтнаму», яка була опублікована в журналі «Foreign Affairs». В цій публікації він закликав визнати «реальність Китаю» і приступити до проведення такої політики, яка сприяла б поверненню КНР у міжнародне співтовариство в якості «великої і прогресивної нації, а не епіцентру світової революції» [11, с. 122-124].

Кандидат від республіканської партії йшов до перемоги на президентських виборах 1968 р. використовуючи зовнішньополітичні концепції своїх політичних опонентів – лібералів, за якими закріпилася репутація «умиротворителів комунізму». При цьому він користувався безперечною перевагою в цих діях, оскільки належав до консервативного табору.

Отже, незважаючи на наявність в США певних настроїв на користь визнання КНР як політичної реальності міжнародного життя, питання про юридичне визнання комуністичного Китаю в другій половині 60-х рр. XX ст. постійно відсувалося на другий план. Навіть у 1968 р, коли США заполонив масовий антивоєнний рух, опитування громадської думки показували, що незважаючи на критичне ставлення до ситуації у В'єтнамі, збереження військової присутності Вашингтону в Індокитаї схвалювалося головним чином через «китайський фактор».

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DEVELOPMENT AND ACTIVITIES OF CHILDREN'S AND YOUTH ORGANIZATIONS IN UKRAINE (1985-2000)

Abstract.
The article considers the evolution of children's and youth organizations of Ukraine during the years of socio-political transformations and the development of an independent state. The forms and methods of activity of informal youth organizations under the conditions of Soviet Ukraine and their development in the first years of independence are analyzed.

Keywords*: children's and youth organizations, social and political transformations, informal organizations, state policy.*

Children's and youth public organizations are an important component of a mature civil society, evidence of the evolutionary development of public initiatives aimed at educating and socializing the younger generation. During the Soviet Union, only the Communist Youth Union and the pioneer organization had the right to work with youth and children, and therefore almost always existed alone, protected from possible competition by the full force and authority of state structures. However, from the beginning of Horbachov's policy of "rebuilding", informal youth organizations began to emerge in Ukraine, which marked the beginning of a new stage in the youth movement. Changes in the youth environment, social psychology, have occurred so rapidly that scientists have not always had time to record and analyze the directions and trends in the development of amateur youth initiatives.

Analysis of recent research and publications. Only in 1989-1990 the definition and typology of informal youth structures and movements were reflected in the works of scientists. Thus, A. Gromov and O. Kuzin believed that informal associations are voluntary amateur social formations that emerged on the initiative of "bottom", which act in the interests of their members, regardless of the purpose and nature of the association [1, p. 9]. According to A. Razumkov, amateur and informal associations were not identical. If amateur organizations united young people on the basis of personal interest of each of them in joint activities on the basis of self-government in order to realize common interests in various spheres of public life, informal associations focused mainly on interpersonal communication, met socio-psychological needs [2, p. 8-9]. V. Kononov generally rejected the division of social structures into formal and informal, believing that the latter exist both outside and within the formal [3, p. 39].

Researchers tried to find out the origins and social base of youth organizations. An important impetus in the creation of youth associations was the change of socio-political processes in Ukraine, the proclamation of pluralism of political thought. A. Razumkov noted that in the period 1985-1987, more than 60 percent of youth groups united young people for leisure. And since 1987 the process of formation of organizations of socio-political, national-cultural, ecological character begins. [2, p. 11-12] The deepening of the politicization of the youth movement took place after the constituent congress of the People's Movement of Ukraine for "Rebuilding". [4, p. 100] V. Golovenko and O. Kornievsky considered Ukrainian students to be the main subjects of the youth movement for deepening democratic transformations in society. [5, p. 75] It should be noted that the activities of the Union of Independent Ukrainian Youth (UIUY), the Union of Ukrainian Students (UUS), other politicized youth organizations of the period 1989-1991 are covered in detail in the works of V. Golovenko, O. Kornievsky.

The activity of the most popular socio-political organization of youth during the perestroika period, the Leninist Communist Youth Union of Ukraine (LCYUU), is analyzed in the monograph "Political Parties and Public Organizations in Ukraine" by K. Bogomaz. Among a number of reasons that led the Komsomol to its existence in September 1991, the author singles out the rigid centralism, the immobility of the executive structures, the formal attitude to the problems of youth, the imperfection of the system of governing bodies. [6, p. 27-31] Quantitative and qualitative composition of the Komsomol organization considered in his works V. Golovenko. [4, p. 97-99] The authors, analyzing the causes of the Komsomol crisis, rightly agree that the LCYUU under a totalitarian regime acted as a structure that was completely dependent on the ruling Communist Party.

Some studies identify the stages of formation of new youth organizations. The first stage (mid-1980s to late 1989) covers the period from the emergence of informal youth groups and associations based on common interest to the emergence of youth discussion clubs, environmental cultural organizations. The proclaimed organizations were democratic in nature, advocated democracy, freedom of speech, and assembly. The second stage (end of 1989 - end of 1991) is characterized by the gradual transition of newly formed

youth organizations in opposition to the current government, the crisis and decline of the Komsomol of Ukraine. The third stage began with the proclamation of Ukraine's independence. [7. p. 55-58]

M. Holovaty played an important role in the study of the problems of the youth movement in Ukraine. Given the state of scientific development of the topic, he focused on the study of factors and features of the formation of new youth associations in the process of establishing Ukrainian statehood; considered ways of formation, features, character and mechanism of realization of the state youth policy in modern Ukraine; assessed the place and role of youth organizations in the political system of modern Ukraine; noted the participation of young people in reforming the economy, spiritual life, the activities of legislative and executive structures. Of fundamental importance is the researcher's conclusion that the state youth policy is a kind of mechanism through which the state, as well as political parties, associations, organizations, movements enter into appropriate relationships with young people, contribute (or not) to the realization of their interests, requests and needs. [8]

O. Kornievsky, who in 1993 defended his dissertation on the topic: "Youth movement in the recent history of Ukraine (the second half of the 80's - early 90's)" is working fruitfully on youth issues. In 1997, he co-authored with V. Yakushyk a monograph "Youth Movement and Political Associations in Modern Ukraine", which conducted a thorough analysis of changes in the socio-political orientation of youth during the years of independence. The crisis situation in the society has led to the spread among the youth of orientations to solve their life problems on their own, without hope for the help of state or public structures. The membership of youth in political parties and movements during 1993-1996 was two percent, in youth associations – 5-6 percent. [9]

In the process of generalization of factual materials about youth organizations, their classification is carried out. Researchers O. Kornievsky and V. Yakushyk classified youth NGOs according to the main goals and activities, which are enshrined in their program documents, highlighting the following groups (varieties): organizations focused on solving various social and economic problems of youth; youth charities; youth "stylistic" organizations that were created to protect and implement youth non-political initiatives (environmental, cultural, artistic, sports, etc.); associations that aimed to train nationally conscious intellectuals; children's and youth organizations; associations of young people who focus on socio-political activities; youth organizations of religious orientation; youth informal organizations, including alternative lifestyle groups; youth societies established on a national basis. [10, p. 2-5] In our opinion, the disadvantage of the classification is its excessive detail. In addition, practice shows that the statutory requirements do not always coincide with the real affairs of the organization.

However, researchers of the youth movement were left out of children's and youth organizations of Ukraine, their formation in the context of socio-political transformations of Ukrainian society.

The purpose of our article is to study the development of children's and youth organizations in the context of socio-political and ideological transformations in Ukraine during 1985-2000.

Presenting main material. The legal status of the pioneer organization was determined in accordance with the documents of the Komsomol and party bodies. In accordance with the decisions of the V Congress of the Revolutionary Communist Youth Union in 1922, a single children's communist organization was formed. The congress approved its structure, principles of operation, the main elements of the program. The latest Regulations on the All-Union Pioneer Organization. V. Lenin was approved by the Bureau of the Central Committee of the All-Union Communist Youth Union (Komsomol) on March 17, 1967. It noted that the pioneer organization was a mass amateur communist organization of children and adolescents in the Soviet Union, a change and a reserve of the Communist Youth Union. [11, p. 44]

A new stage in the development of the youth movement in Ukraine began in the mid-1980s, which was directly related to the proclamation of the policy of democratization and publicity. It was an attempt to maintain party control over the activities of informal youth associations and groups, which began to emerge among young people as a form of protest against the formalism and bureaucratization of state-owned children's and youth organizations. The Vinnytsia Regional Committee of the Communist Party informed the Central Committee of the CPSU about the way in which the ideological orientation of amateur youth organizations is controlled. In 1988, there were about 1.5 thousand amateur groups and interest clubs in the region, of which 280 emerged in 1985-1988. Among them, the most numerous were associations of socio-political, artistic, sports and health areas. The relevant department of the regional committee of the Communist Party of Ukraine analyzed in detail the activities of informal associations "Bereg", "Klyuch", "Meeting with the 10th Museum", "Studio 5", folklore and ethnographic expedition "Podillya", amateur song clubs, fiction, rock music. A meeting was held with their leaders in the regional committee of the Young Communist League of Ukraine. [12, p. 44]

A peculiarity of these associations was amorphousness, lack of organizational structures, programs and statutes. At that time, the legal framework for the activities of informal associations, which were able to legalize their activities only under the patronage of "traditional" organizations - the Komsomol, trade unions, creative unions - was not worked out. Having the necessary material and technical base, an extensive staff of dismissed workers, the Komsomol tried to lead young informals. A voluntary society for the construction of MZhK, a city center for scientific and technical creativity of youth (NTTM), a number of military-patriotic clubs, which prepared young people for service in the armed forces of the USSR, educated the younger generation in the spirit of patriotism and internationalism. At the beginning of 1989, there were 10 military-patriotic clubs in Vinnytsia. Among them the largest were: "Leninets", which numbered 320 people, "Dome" -

260, the club at school №7 - 120, "Duel" - 78, Patriot - 60 people. There were 1,350 cadets in the clubs, of which 65 percent were schoolchildren, 25 percent were students of vocational schools and technical schools, and 10 percent were working youth. [12, p. 49] Club "Leninets" united an ideological, physical culture and sports, sociological center, was a center of leisure for the surrounding youth. Clubs of fans of fiction, international relations, and modern music worked within the framework of this association; sections of sambo and judo, Chinese gymnastics, tourism. [12, p. 50]

On March 31, 1988, the city youth association of teenage clubs "Position" was established. The association was organized to increase the socio-political and social activity of young people, the broad involvement of the younger generation in scientific, technical creativity, leisure. At the beginning of 1989, the association included clubs of ultralight aircraft, vehicles, radio electronics and computer equipment, the military-technical club "Dome", the club of young sailors "Brigantine" and others. Educational work covered 800 children and adolescents. In 1988, the city committee of the Komsomol allocated 120 thousand rubles for the development of the "Position". [13, p. 4] In 1989, 300 thousand rubles were allocated [14, p. 75].

A network of clubs, teen rooms, clubs, sports sections at the place of residence, etc. played a significant role in the upbringing of children and adolescents outside the team in which they studied. At the beginning of May 1988 in Ukraine under the leadership of the Ukrainian Republican Council of Trade Unions 900 youth clubs were established, in which 1430 amateur associations were organized with the number of participants about 57 thousand people, 786 rhythmic gymnastics groups, 130 clubs and sections of athletic gymnastics. engaged in 25 thousand people. [15, p. 187] There were 15,439 amateur associations and clubs in state club establishments. 3682 subdivisions of cultural and sports complexes worked with the youth. 2498 new children's groups of amateur art were created, in which more than 42 thousand participants were engaged. [15, p. 196]

Informal groups of adolescents and young people have been appearing in Ukraine since 1985, often in the basements of deserts and wastelands under the leadership of demobilized soldiers who had served in Afghanistan. In January 1988, under the auspices of the LCYUU, the Republican Center for Military and Patriotic Education began its work in Sevastopol - patriotic education. In 1988, the Center trained about 600 specialists. At the beginning of 1989, there were about 1,000 military-patriotic associations and clubs in Ukraine, with about 50,000 teenagers. [16, p. 114-115]

In 1989, there were about 130 military-patriotic associations and clubs in the Zaporizhia region. They trained more than 20,000 teenagers for military service. Among the clubs, the most famous were the Brotherhood. "Duty", "Change". In December 1988, a regional center for military and patriotic education was established to coordinate the work of the clubs. The center worked in three areas: preparing young people for service; providing assistance to the families of those killed in Afghanistan and the disabled; search work.

In 1989, search teams found the remains of 415 dead soldiers, searched for relatives of 263 soldiers and officers. Lists of more than 30 thousand dead have been compiled. The group "Search", which was engaged in perpetuating the memory of those killed during the Great Patriotic War, and the group "Rehabilitation", which immortalized the names of Cossacks who died during Stalin's repressions, worked in close contact. [17, p. 9]

Considerable attention was paid to the prevention of juvenile delinquency. In the late 80's of the twentieth century, this work was carried out by 779 commissions for minors, about 7 thousand public inspectors, more than 9 thousand organizers of extracurricular activities and 16 thousand pioneers, 3 thousand educators and physical education instructors in housing and operational offices (ZhEK), 14 thousand public educators, 32,5 thousand chief mentors. [18, p. 9]

Thus, in the second half of the 1980s, Ukraine had a diverse system of educating the younger generation, which relied on the full support of the state and did not go beyond communist ideology.

On November 21, 1990, at the XI Republican Rally of Pioneers of Ukraine, the Union of Pioneer Organizations of Ukraine (UPOU) was established as a non-political, public association of children and adults. At that time, the SPOU united 25 regional and Kyiv city pioneer organizations, and included 687 city and district organizations, which included more than 2.5 million pioneers. [19, p. 22] Despite the change of the sign, the inertia of political life kept the pioneer organization in the orbit of the Komsomol and the CPU for some time. The urgent problem was to find funds for the needs of the newly created organization. The XI Republican Rally of Pioneers appealed to the Verkhovna Rada of Ukraine for grants, but the problem was solved sluggishly and the Komsomol joined the cause. On January 15, 1991, the Central Committee of the LKSMU sent a letter to the Politburo of the Central Committee of the Communist Party of Ukraine, requesting consideration of a grant to the SPOU Coordinating Council in the amount of 3 million rubles. rubles needed for the revival and formation of pioneer organizations in Ukraine, as well as a minibus and a car for the Coordination Council of the SPOU. " [19, p. 24-29] In addition, a special resolution "On the need for comprehensive support of the Union of Pioneer Organizations of Ukraine" was adopted, which defined a new strategy for relations with the pioneer organization. “The CPU considers the pioneer organization not as a children's association of its party, but first of all as a patriotic organization that directs its efforts to the development of children's talents and abilities, education of high civic qualities, collectivism, love for the Motherland, respect for laws, attributes and symbols of the state ”[20, p. 28]. The last paragraph of the resolution clarified everything, in which it was recommended "regional committees, city committees, district committees of the Communist Party to organize a broad explanatory work among the Communists about the importance of the pioneer movement in the party's struggle for youth, for the socialist future of our country." [20, p. 30] The manifestation of such attention by the "older brother" in the

past thus had a political basis. The search for political allies among public organizations did not help the CPU in the struggle for a "socialist future."

The pioneer organization continued its activities in independent Ukraine in accordance with the programs - guidelines for the activities of pioneer cells, which were adopted at the first meeting of the SPOU. These are the programs: "Berehynia" - the revival of the best traditions of the Ukrainian family; "Believe in yourself" - the assertion of personality through useful deeds for all; "Kotigoroshko" - hardening of body and spirit in the name of protection of the native land, goodness and justice; "Red Viburnum" - the study of history, culture, ethnography of its people; "Pioneer - leader" - the development of organizational skills, culture of human relationships; "Help" - preparation for independent work, acquisition of economic communication skills; "My stork's land" - the affairs of adults and children to protect native nature. According to the UPOU Coordination Council, at the beginning of 1998 it consisted of about one million children and adults. [21, p. 123]

The democratization of socio-political life in Ukraine in the second half of the 1980s led to the emergence of various youth and youth organizations that were outside the party's influence. Many of them were the result of the informal wave, which was a nourishing solution for new associations. Thus, in 1990, the Union of Minors began its work in Kharkiv, which considered itself a voluntary non-political organization of children, adolescents and adults. The purpose of the Union's activities was to implement the Convention on the Rights of the Child, to promote the depoliticization of the school. An independent children's press agency was set up in Evpatoria, uniting children (from 12 years old) and adults. The agency was established to develop children's creative abilities and protect their rights and interests. At the beginning of 1991, the organization had about 100 members - young journalists and photographers. In 1989-1991 the Boryspil City Patriotic Association "Rovesnyk", the ecological center of schoolchildren and students at the ecological organization "Ecoforum" (Kharkiv), Sicheslav Brotherhood (Dnepropetrovsk), Sichovy Striltsi (Kyiv) were established. . [19, p. 282]

In the western regions of Ukraine, the restoration of youth and children's organizations, which existed there until September 1939, began. In January 1989, the process of revival and development of the Plast children's and youth organization began in the Lviv region. In July 1989, Plast tried to set up a tent camp in the woods, which was banned by law enforcement in August of that year. [22, p.134] On December 16, 1989, the Board of Trustees of Plast was established. In 1990–1991, Plast organizations, numbering from 3 to 300 people each, were established in 20 regions of Ukraine and in Kyiv. On October 19, 1990, the first stage of the Constituent Assembly of the organization took place, which ended with the formation of temporary commissions. The last, third stage of the congress, which took place on April 12-13, 1991 in Ivano-Frankivsk, ended with the adoption of the Statute of the Ukrainian scout organization Plast. [19, p. 283]

The layer appeared in 1911. It was preceded by a book by British General Robert Powell, Scouting for Boys, which was published in 1907. The ideas of a non-traditional (at that time) system of youth education are becoming popular in Europe. There are national scout organizations. The founders of Plast were young teachers Petro Franko, the son of the famous Ukrainian writer Ivan Franko, and Ivan Chmola. The organization borrowed its name from the name of the scouts of the Cossack army - Plastuns. The official beginning of Plast is considered to be April 12, 1912. On this day, members of the circle at the Academic Gymnasium, organized by O. Tysovsky, took the Plast oath. The organizers of Plast sought to preserve the internal meaning of the scout movement, to give the youth organization a unique national form and connect it with the Ukrainian folk tradition. [23, p. 18]

The ideological foundations of Plast are expressed in the Plast oath, which reads: "I swear by my honor that I will do everything in my power to be faithful to God and Ukraine, to help others, to live according to the Plast Law and to obey the Plast leadership." [24, p. 63]

In the arsenal of Plast's work - the organization of tent camps, most of which are educational, and the rest - specialized: hiking, water, sea, environmental, sports, etc. During the year, in addition to the camps, various events are held: historical and patriotic, ceremonial, creative, sports, tourist trips. At the beginning of 1998, more than 3,500 people were fixed members of Plast, including 3,300 children aged 6 to 17. Plast has established more than 70 branches in most regions of Ukraine. Branches of the organization are established in 12 countries of the world. [21, p. 101]

Another scout organization was formed in Ukraine, which connected its origins with the scouts of the times of the Russian Empire. The first scout units appeared in the Crimea in 1989. In 1993, the Federation (later the name was changed to the Association) of the Crimean Scouts was formed. In the summer of 1995, at a conference in Yalta with the participation of representatives of scout organizations in Kyiv, Crimea, Odessa, Zaporizhia and other cities of Ukraine, an organizing committee was formed to prepare for the constituent congress, which took place on February 25, 1996. At the beginning of 1998, the Scout Association of Ukraine united 17 regional organizations in different regions of Ukraine. It consisted of about 5 thousand members. [21, p. 42]

The Ukrainian children's and youth society "Sich" considers itself a new national form of the scout movement. In 1991, the Sichi youth center and the first Cossack evening-Sunday school were established in Kyiv, which initiated the unification of children's Cossack centers. The process of creating a single organization was completed on January 9, 1993 at the founding council of the Ukrainian Children's and Youth Society "Sich". The purpose of the society is to promote the education of nationally conscious, spiritually and physically developed citizens of Ukraine on the traditions of the Ukrainian Cossacks and the principles of Christian morality. At the beginning of 1998, Sich had branches

in 18 regions of Ukraine and had about 15,000 members. [21, p. 168-169]

The Scout Movement of Ukraine remained outside the scope of the World Scout Movement (WSM). The main reason was the ambition of the leaders of the scout organizations, who failed to resolve the issue of creating a single all-Ukrainian organization or at least an association of scout organizations in Ukraine. In June 1997, the Coordinating Council of Scout Organizations of Ukraine was formed, which aimed to solve this problem, but its work did not yield the desired result. [25, p. 96]

The activities of scout organizations are focused mainly on educating boys in purely masculine qualities and skills. Promoting the full development of girls and young women is the main goal of the World Association of Guide Girls and Girl Scouts, the largest international women's organization with 10 million members from 136 countries. [26, p. 44]

In the spring of 1992, Boire Wallstad, a member of the Norwegian Scout and Guide Association, and Rosie Dunn, program coordinator for Central and Eastern Europe, visited Ukraine for the first time. In October 1994, the first all-Ukrainian training for the leaders of the Hayd movement took place in Kyiv. On November 25, 1995, the founding conference of the Association of Guides of Ukraine (ASU) took place. The conference adopted and approved the charter of the ASU and elected governing bodies. In November 1996, the organization was officially registered with the Ministry of Justice of Ukraine. At the beginning of 1999, the ASU consisted of about 1,000 activists.

The main activities of the organization are conducting various seminars and trainings; participation of representatives of the organization in various conferences, forums, seminars that contribute to the formation of national and international youth policy; organization and holding of children's and youth girls' camps; participation of guides in environmental projects; conducting regular classes with girls in order to promote the development of vital habits. [26, p. 45]

Important importance in the activities of children's organizations is given to environmental work. During the years of independence, a number of ecological children's associations started working. In 1993, a children's ecological center "Bee" was established in the city of Horlivka. The team of educators-educators on a voluntary basis joined forces to attract children with a "green" idea, to instill in their souls a love for their homeland. Over the years, hundreds of schoolchildren gathered at the Center, made bird feeders, and studied the history and nature of their native land. In January 1996, the staff of the Center, with the help of the city environmental association "Green Movement" and the regional environmental association "Green Movement of Donbass" began work on the creation of a regional center of environmental education "Ekodonbass". In April 1996, the regional center began operations. A seminar was held for primary school teachers, leaders of environmental groups and other organizations dealing with children's environmental education. [27, p. 41-42]

Since 1989, Ecocenter, an ecological public organization for children and youth, has been operating in the Kharkiv region. It brought together students from city schools and vocational schools, technical schools, out-of-school groups, university students, and researchers. Since 1990, the Kharkivkommunpromvod territorial and production association has been cooperating with Ecocenter, which is interested in researching the sanitary and hygienic condition of the Seversky Donets River. Annual environmental expeditions help to obtain objective information about the suitability of water for consumption and sources of pollution. Since 1993, the expedition has been supported by grants from the Kyiv office of the American non-profit organization ISAR (Center for Support of the Development of the Public Environmental Movement in Eurasia) [27, p. 128-129].

From 1993 to 1998 ISAR provided methodological, technical, financial assistance to 49 projects in Ukraine, Belarus and Moldova, including grants from 15 children's environmental organizations of Ukraine - student eco-club "Vodogray" (Chernivtsi), children's environmental association "Gay" (Sevastopol), Compass Club (Kyiv), Murashnyk Children's Charitable Foundation and others.

The development of children's environmental movement is facilitated by government agencies. In 1999, the Ukrainian State Ecological and Naturalistic Center (UDENC) held the First All-Ukrainian Forum of Children's Public Ecological Associations, which expressed a desire to establish a Coordinating Committee - the Children's Ecological Parliament. [28, p. 2]

Thus, the development of children's and youth organizations in Ukraine during 1985-2000 took place in three stages. At the first stage (1985-1989), the pioneer organization remained the only mass children's organization. It operated under the leadership of the Communist Party and the Komsomol. Funding for the work of numerous out-of-school institutions was provided by both the state and state-owned public organizations (Komsomol, trade unions). Despite the formalism, the ideology of educational activities, there was a diverse system of education of the younger generation.

A characteristic feature of the second stage (1989 - 1991) is the crisis of confidence in the communist idea as a core in the upbringing of the child. Informal children's organizations, which openly oppose themselves to pioneer structures, declare themselves loudly. They turn to the origins of Ukrainian culture, revive traditional forms and methods of education. There are changes in the pioneer organization of Ukraine, which declares its independence from the union structures and the rejection of the ideological factor in education.

The third stage (90s of the twentieth century) of the children's movement in Ukraine is characterized by significant differentiation in the activities of children's associations, increasing the number of children's organizations The emergence in the early 90s of the twentieth century various charitable foundations and international organizations provide funding for not only the children's sector, but also public organizations in general, has reduced the role of the state in determining the strategy and activities of children's associations. Local

organizations began to play an increasing role. Statistics show that at the end of 1999 there were 8 all-Ukrainian and international children's organizations in Ukraine - the Union of Pioneer Organizations of Ukraine, Plast - Ukrainian Scout Organization, Ukrainian Youth Aerospace Association "Constellation", Ukrainian Children's and Youth Society "Sich". Association of Guides of Ukraine, Association of Scouts of Ukraine, Youth Organization of the Union of Officers of Ukraine "Falcon", Children's Fund of Ukraine. While at the regional, city, district levels there were 850 organizations. [29, p. 6]

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RECONSTRUCTION AND RESTORATION OF THE WORK OF THE DNIEPER HIGHWAYS IN 1943 - 1945

Abstract.

The article examines the reconstruction work on the railway transport infrastructure of the Dnieper region, which is important in economic and strategic terms. This region after the Nazi occupation inherited a critically destroyed state of railway transport, and for the recjnstruction of industrial enterprises, Dniproges railway network was extremely necessary. Reconstruction of the railway, its work was important not only for the revival of the Dnieper region, but also the southern regions of Ukraine. A significant team of railroad workers was formed. Gradually the level of their professionalism increased, the social sphere was revived.

Keywords*: Dnieper railway, Dnipro (Dnipropetrovsk), Zaporizhia, railway transport.*

Reconstruction processes on transport in different regions of Ukraine took place differently and had their own peculiarities. Therefore, studies on the regional history of the Second World War are on time, because they allow us to clarify the specifics of the processes that took place in Ukraine during the years of economic reconstruction, and thus understand the basic patterns. Today, in terms of partially destroyed economy of Donbass, it has an applied nature.

To study the problem of some importance are some published works: "Dnieper Railway" [7], "Restoration of the Dnieper. Documents and materials ", other scientific researches [3].

A brief reference to the history of the Dnieper highway shows that its construction began in 1875, the routes of which provided access to the seaports of Kherson and Tavriya provinces, and also provided bread supplies to the central provinces of the Russian Empire. In terms of freight turnover, the highway took first place among all in the Russian Empire in the early twentieth century. In the 1920s, the Yevpatoria-Sarabuz and Dzhankoi-Armyansk tracks were built. On January 4, the highway was renamed Stalin's, and in 1961 a new one was named Prydniprovska. The highway served large industrial centers of Ukraine: Dnepropetrovsk, Zaporozhye, the territory of the Kherson region and the Autonomous Republic of Crimea [8].

The German-Soviet war completely changed the lives of railroad workers. Hitler's command at all costs tried to keep the Zaporozhye place of arms, as its loss entailed the loss of the Crimea [10, p. 234]. Therefore, neither the Wehrmacht nor the deep German rear could do without transport infrastructure [2, p.11]. This was typical for the Red Army, because after the departure of the occupiers, the existing fleet of road and rail transport in Ukraine was insignificant [2, p.59]. Therefore, there was an urgent need to rebuild the railways.

Before the war in Dnipro (Dnipropetrovsk) there were: locomotive repair, car repair, switch, traffic light and electrode plants. In Zaporozhye - locomotive repair. Personnel of highly qualified railway workers were trained at the Dnipropetrovsk Institute of Railway Engineers. The commissioning of the above-mentioned enterprises and institutions created more favorable conditions for the reconstruction of the transport network of the region and Ukraine. "11. Central State Archive of Public Associations of Ukraine (TSDAGO of Ukraine). F.1. Op.77. Ref.47. Arc. 28].

Troops of the South-Western (since October 20, 1943, 3rd Ukrainian) front under the command of Malinowski R.Y. from October 10 to 14, 1943, the left bank of the city of Zaporizhia was liberated from fascist invaders. The battles for the island of Khortytsia lasted until December 29, 1943 [10, p.242]. Soviet troops completed the liberation of the left bank of the Dnieper (Dnipropetrovsk) on September 20, 1943 and from there struck at enemy positions on the right bank. Almost a month later, on October 25, the city was finally liberated from the Nazis [1, p. 93, 96].

In the spring of 1944 there were battles with the Nazis on the territory where the paths of the Stalin (Dnieper) railway ran. On March 15, stations and railways on the right bank of the Dnieper River were cleared of fascist occupiers [7, p.156].

The invaders retreated, tore down 3,500 turnouts and 4 tunnels, destroyed 38 large, 35 medium and 602

small bridges, damaged equipment, causing damage of 1.4 billion rubles [7, p. 157]. .

A major problem for the advancing troops and railways in Ukraine and, in particular, the Dnieper region, was the reconstruction of bridges. On the roads of the North-Donetsk, South-Donetsk, Southern and Stalinist highways of the railway bridges, the occupiers tore down and burned 2087, or 80 percent [11.CDAGO of Ukraine.F.1. Op.77. Ref.47. Arc. 209]. During the retreat, the occupiers destroyed two bridges in Dnipro (Dnipropetrovsk) with a length of 1524 and 1383 meters and in Zaporizhia bridges across the old Dnieper - 370 m and the new Dnieper - 738.1 m. [11. TSDAGO of Ukraine.F.1. Op.77. Ref.43. Arc. 43].

Reconstruction of bridges significantly affected the supply of troops advancing on the territory of the Right Bank of Ukraine. A temporary wooden bridge on the Dnieper River in Dnipro (Dnipropetrovsk) was built within 33 days, on which on December 10, 1943 the echelons began to move. Until now, there was a pontoon crossing [7, p.159].

In the area of Dnipro (Dnipropetrovsk) from October 25, 1943 UBVR of the 3rd Ukrainian Front for 7.5 days, built a railway pontoon crossing, which played an important role in providing troops that expanded the place of arms on the right bank of the Dnieper. From November 14 to December 11, 1943, 247 trains (12,266 cars) with cargo for troops passed through the bridge. [4, p.212].

In the area of Dnipro (Dnipropetrovsk) bridges were renewed in two stages. First they built a floating, then high-water temporary bridges on the bypass. A special pontoon-bridge regiment from the rear areas arrived to perform the work. Together with the railways, 156-meter-long overpasses were built. The transition itself was built for 8 days, laying 105 meters daily [4, p.211].

At the same time, a high-water bridge was being built, for which 1,088 piles were driven in, and 192 span structures weighing four tons each were installed. 33 intermediate structures of 20-35 tons each were installed, and two overpasses over 200 meters long were erected. The works were carried out from November 1 to December 10, 1943. Difficulties with its operation arose in the spring of 1944, during the ice drift, when the personnel of three battalions built icebreakers around the clock and restored damaged bridge structures [4, p.211].

Also, in order to restore the movement of the echelons, it was necessary to restore the inter-node communication, without which the work of transport is not possible. For this used trophy and domestic equipment. The connection was established on November 30 between Dnipro (Dnipropetrovsk) and Sukhachivka, others stations. Overcoming difficulties, it was possible to restore the connection between the stations of the left and right banks of the Dnieper [7, p.159].

While the work was opening, for the reliability of bridge structures, the Stalinist Railway Department together with the Dnipropetrovsk Institute of Railway Engineers created bridge test stations consisting of: chief, with a monthly salary of 1,400 rubles; Art. engineers (2 people), respectively - 1 thousand rubles; engineers (3 people) 800 rubles; Art. technicians (2 people) 600 rubles [11. TSDAGO of Ukraine. F.1. Op.77. Ref.33. Arc. 93-94]

As soon as the Nazis were expelled from Zaporizhia, the reconstruction of temporary one-and-a-half-kilometer bridges across the old and new channels of the Dnieper began. In Zaporozhia, the enemy destroyed two bridges. The temporary bridge was built downstream, pouring more than 500 thousand cubic meters of canvas. Two more bridges were built across the Old and New Dnieper, 1886 meters long, six medium bridges, and 14 kilometers of road. They were operated until 1952, when they were replaced by capital ones [4, p.213]. At the beginning of their reconstruction was hampered by great destruction. Also, the dam of Dniproges was badly damaged. Therefore, it was decided to rebuild a temporary bridge over the Dnieper River, the island of Khortytsia, through the southern part of the Old Dnieper. For the second time, the railway guards had to build such a bridge. The mini fields on the island of Khortytsia were especially disturbing. The difficulty also lay in the fact that in January 1944 the thaw began and the air temperature rose to + 5 + 8 degrees. The snow was melting. It rained, there was no road. Civil railroad workers and the local population came to the rescue, forming 12 labor battalions of 500 each. Snow and rain prevented the pace of work from increasing. The first stage of the bridge was put into operation on February 22, 1944, which was of special importance during the intense battles of the troops of the 3rd Ukrainian Front with the German invaders on the Right Bank of Ukraine [5, p.361]. The resumption of the Zaporizhia and Dnipropetrovsk railway junctions contributed to the reconstruction of the region's powerful enterprises.

The highway had to be rebuilt in difficult conditions. Enemy planes often bombed stations: once a bomb hit a tank of gasoline and a pillar of fire rose. The flames engulfed the train. But the station chief Moisey Panteleimonovich Tereshchenko, who ordered the removal of trains from the affected area, was not confused, and the fire attracted the attention of the enemy, who continued to bomb the station. The railway workers did not leave their jobs and continued to perform their duties as dispatcher Deiko, train builder Reva, hitchhiker Babenko, and switchman Tereshchenko. They continued to separate the wagons and put them in a safe place, not afraid of the flames that continued to erupt. They did this manually without using a locomotive due to a damaged track. They managed to save 220 tons of food. Two tanks of gasoline remained in the fire. One was punctured and fuel leaked from it. They manually eliminated the hole, extinguished the fire and immediately started repairing the track. No one left the workplace until the station's capacity was restored, and then the echelons began to pass to the front line.

It is worth noting that the scale and pace of restoration work on the highway depended on personnel, production capacity and material resources. The source of replenishment of vacancies in transport were railway workers who were engaged in servicing the railway in the occupied territories and who were not subject to mobilization into the active army. Thus, by the Resolution of the GKO of November 22, 1943 and the decision of the SNC of the USSR and the Central Committee of the Comunistic Party /b/ U of November 30, 1943, the railroad workers who remained in the temporarily occupied territory were subject to mobilization for reconstruction work. Soviet and party bodies of Dnipropetrovsk, Zaporizhia regions and Crimea registered in

1944 6985 people and 615 workers of other roads [11.CDAGO of Ukraine. F.1.Оп.77.Спр.234. Arc. 11]. Also, in agreement with local party and Soviet authorities, local workers were involved in transport. This lasted until July 1944. This practice had a positive effect on the reconstruction of transport, but from the second half of 1944 the replenishment of the highway with local labor significantly deteriorated. This was due to the fact that in parallel with its restoration, work began on the reconstruction of enterprises and institutions of other industries in Kryvbas, Donbass, Dnieper, Dniproges, where local authorities directed the flow of labor. A total of 18,970 local people were hired on the highway. 1135 workers were sent to other highways of the former USSR [11. TSDAGO of Ukraine.F.1.Op.77.Spr.234. Ark.11].

They also used forced labor, as evidenced by a letter from the secretary of the Central Committee of the Communist Party M. Khrushchev dated December 1, 1943 to the heads of regional executive committees of Kharkiv, Sumy, Poltava, Stalin, Voroshilovograd, Chernihiv, Dnipropetrovsk, Kyiv and Kursk regions. that on the basis of the decision of the T-bills of November 22, 1943 "On urgent measures to strengthen the farms of the railways liberated from the German occupiers" all employees, both mobilized and voluntarily recruited into the UBVR system of railways, are assigned to permanent work Decree of the Presidium of the Verkhovna Rada of the USSR of April 15, 1943 "On the imposition of martial law on all railways" and "Statute on the discipline of workers and employees in railway transport." Therefore, the Central Committee of the CP / b / U asks to immediately instruct the district military registration and enlistment offices of the mentioned regions to accelerate conscription into the Red Army and mobilization of these workers for other types of work [6, p.671].

The pace of reconstruction depended on the availability of resources and equipment. Work began on the basis of local resources. Over time, production equipment on objects of transport came from the funds of the NKSHS. In 1944, the reconstruction of 14 locomotive repair plants on the territory that existed before began occupied by Nazi invaders. Then the Dnepropetrovsk enterprise was allocated 152 units of metal-cutting equipment, three compressors. In 1945, 76 more metal-cutting machines and 10 welding units were also allocated to the enterprise. A total of 228 metal-cutting machines and 30 units were involved in the production. This gave at that time the opportunity to implement the state plan for the repair of locomotives and spare parts for them. [11. TsDAGO of Ukraine. F.1. Op.77. File 7. Ark.28].

The revival of railway stations was another important problem of reconstruction. Thus, the station of Zaporozhye station was completely destroyed by the occupiers. Due to the lack of the necessary premises, the shop of the transport consumer society was temporarily used for this purpose. A similar situation lasted until 1947. During this time, local authorities allocated 190 and 123 thousand rubles for its reconstruction. [12. Central State Archive of the Supreme Bodies of Power and Administration of Ukraine (TSDAVO), FR-2.Op.7.Spr.125.Ark. 226].

The staffing and resource provision of the railway sections made it possible to restore 1,694 km of main and 1,308 km of communication lines on the highway by the end of 1943, and by October 25, 1944, 2,366 km of main roads were put into operation. Also restored 11 stations, 589 production facilities, 30 schools and 137 houses [7, p. 162].

In the process of rebuilding production facilities, the highways tried to solve the social problems of railway workers, youth and children. So, at locomotive repair, car repair and machine-building enterprises of mm. Dnipro (Dnipropetrovsk) and Zaporizhia provided workers with public catering. In April-May 1944, 9 canteens were organized, where 2,470 people were fed, of which 600 were students of FZO. The lunch diet consisted of two dishes, one for breakfast and one for dinner. The quality of food was satisfactory. There were also household enterprises: 5 hairdressers, 3 sewing workshops, tin and watch workshops [11.TSDAGO of Ukraine.F.1.Op.77.Spr.125. Ark.90].

Thus, the reconstruction work on the Dnieper Railway in 1943 - 1945 significantly contributed to the increase of military and economic transportation [7, p.163], as well as the revival of the cities of Dnepropetrovsk and Zaporozhye as important industrial centers of Ukraine.

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EARTH SCIENCES

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СЕЙСМІЧНА РЕАКЦІЯ ҐРУНТОВОЇ ТОВЩІ В ОСНОВІ ТАШЛИЦЬКОЇ ГІДРО-АКУМУЛЮЮЧОЇ СТАНЦІЇ НА ДИНАМІЧНІ НАВАНТАЖЕННЯ

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SEISMIC RESPONSE OF SOIL STRATA AT THE BASE OF THE TASHLYK HYDRO-ACCUMULATING STATION TO DYNAMIC LOAD

Анотація.
В статті представлено результати аналізу сейсмічної реакції різних за будовою ділянок в межах території розміщення основних споруд Ташлицької гідро-акумулюючої станції. Для кожної ділянки розраховано спектральні характеристики моделей ґрунтових товщ та визначено частотні діапазони можливого підсилення сейсмічних коливань ґрунтами. Наведено короткий аналіз отриманих результатів. Показано, що в межах однієї території, ділянки з відмінною геологічною будовою суттєво відрізняються за фільтруючими властивостями відносно сейсмічних коливань.

Abstract.
The article presents the results of the analysis of the seismic response of various sections of structure within the territory of the location of the main structures of the Tashlyk hydro-accumulating station. For each site, the spectral characteristics of soil strata models were calculated and the frequency ranges of the possible amplification of seismic vibrations by soils were determined. A brief analysis of the results obtained is presented. It is shown that within the same territory, areas with a distinctive geological structure differ significantly in filtering properties in relation to seismic vibrations.

Keywords: *seismic response of soil, seismic microzoning, seismic hazard, frequency response*
Ключові слова: *сейсмічна реакція ґрунту, сейсмічне мікрорайонування, сейсмічна небезпека, частотна характеристика*

Вступ. Метою сейсмічного мікрорайонування будівельних майданчиків є прогноз поведінки ґрунтів при можливому сильному землетрусі для попередження руйнування будівель і споруд при землетрусах [4, 6, 7]. Незважаючи на велику кількість робіт в цій галузі, прогнозування поведінки ґрунтів при сильних сейсмічних впливах залишається одною з найактуальніших проблем сейсмології.

Ступінь пошкодження об'єкта під час землетрусу залежить не лише від рівня сейсмічних впливів, але і від якості сейсмостійкого проектування і будівництва. Забезпечення необхідної якості можливе лише при умові правильного прогнозування кількісних параметрів сейсмічної небезпеки майданчика, що здійснюється за допомогою комплексу робіт з сейсмічного мікрорайонування [4]. На цю тему в науковій літературі існує велика кількість публікацій: статті, збірники праць конференцій, монографії та ін. В це число входять основоположні «класичні» праці СМР як вітчизняних – С.В. Мєдвєдєва, Н.В. Шебаліна, Е.Ф. Саваренського, так і зарубіжних – К.Сюехіро, Н.Ньюмарка, Е.Розенблюта, Ш.Окамото та інших.

Перші повідомлення про вплив ґрунту на прояви сили землетрусу можна зустріти в працях російських та іноземних вчених вже на початку XX століття. В постановці проблеми врахування впливу ґрунтових умов значна заслуга належить відомому вченому І.В. Мушкетову [5].

Вплив локальних ґрунтових умов на величину руйнувань вагомо підтвердили матеріали макросейсмічних досліджень Японського землетрусу 1923 р. Результати досліджень викладено в роботі [8]. Було встановлено, що на рихлих водонасичених відкладах ріки Судіми, спостерігалися більші руйнування, ніж на щільніших делювіальних суглинках, з яких складалися схили пагорбів.

Підтвердженням того, що на ступінь сейсмічної небезпеки території сильніше впливають ґрунтові умови, ніж магнітуда або енергія землетрусу, стали наслідки землетрусу в провінції Квебек в Долині Лоуренса (Канада) в 1925 р. На відстані понад 100 км від вогнища були виявлені найсильніші пошкодження і руйнування в будівлях, в основі яких були рихлі відклади ріки Св. Шарля. При цьому стальні конструкції зерносховища були зігнуті, бетонні перекриття скинуті, основи колон з перенапруженого залізобетону зім'яті. В той же час на відстані приблизно 800 м від вогнища землетрусу в великому готелі, побудованому на скельному схилі, мешканці майже не відчули цей землетрус. Локальна інтенсивність на рихлих відкладах склала при

цьому 8 балів, а на скельних ґрунтах – 3 бали згідно модифікованої макросейсмічної шкали Меркалі (ММ) [3]. Таким чином, відмінність в поведінці споруд, обумовлена ґрунтовими умовами, досягала 5 балів. При цьому до сейсмічного ефекту, обумовленого фізико-механічними властивостями ґрунтів, очевидно, додалися, резонансні ефекти.

Сейсмічна реакція ґрунтової товщі території Ташлицької гідро-акумулюючої станції. В роботі приведено результати моделювання сейсмічної реакції ґрунтової товщі території розміщення основних споруд Ташлицької гідро-акумулюючої станції (ГАЕС) на максимально можливі сейсмічні впливи в даному регіоні з врахуванням нелінійних явищ. Ґрунтова товща складена осадовими відкладами і середньо та інтенсивно вивітлилими граніто-гнейсами. В результаті проведення робіт з сейсмічного мікрорайонування за трьома методами: методу сейсмо-геологічних аналогій, методу сейсмічних жорсткостей і методу реєстрації землетрусів, вибухів і короткоперіодних мікросейсм - в межах майданчика Ташлицької ГАЕС було умовно виділено 5 ділянок (таксонометричних одиниць), які характеризуються різними інженерно-геологічними і сейсмічними умовами, в тому числі і різною товщиною осадового чохла та граніто-гнейсів. На рис.1 представлено схему розташування ділянок, виділених на території Ташлицької ГАЕС.

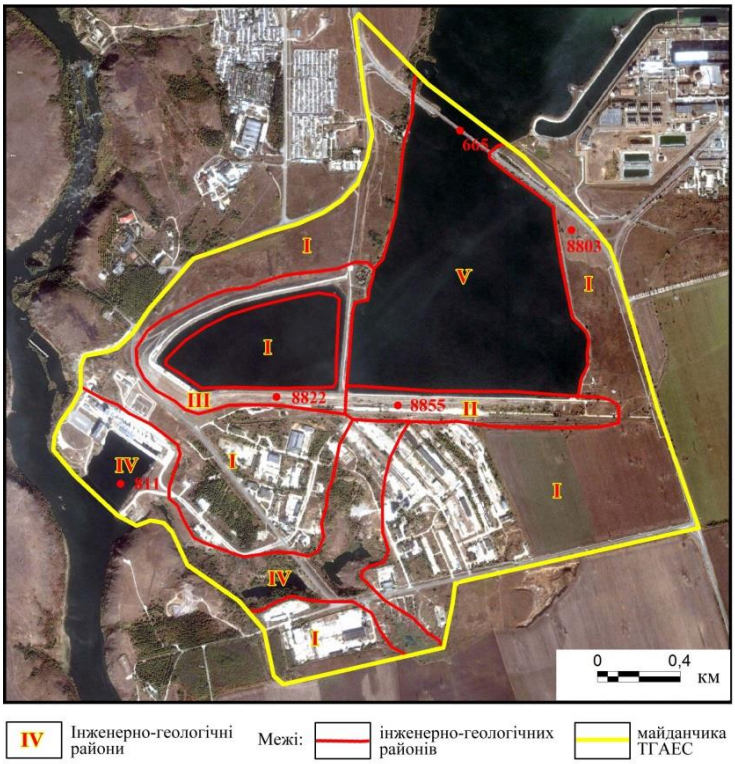

Рис.1 Схема розташування ділянок на території Ташлицької гідро-акумулюючої станції (ГАЕС), виділених за результатами СМР комплексом з трьох методів: методу сейсмо-геологічних аналогій, методом сейсмічних жорсткостей і методом реєстрації землетрусів, вибухів і короткоперіодних мікросейсм

Розрахунки амплітудно-частотних характеристик (АЧХ) ґрунтової товщі території розміщення основних споруд Ташлицької ГАЕС проводилися з використанням програмного комплексу ProShake [2], розробленого для одномірного моделювання відгуку верхньої частини розрізу геологічного середовища на сейсмічні впливи. Частотні характеристики розраховувались з врахуванням нелінійних властивостей ґрунтів для п’яти моделей ґрунтового середовища інженерно-геологічних районів №1 – 5, тобто таксонометричних одиниць. Для кожної з моделей ґрунтового середовища результуюча АЧХ є як обвідною сімейства АЧХ, одержаних для різних випадків падіння з нижнього півпростору сейсмічних коливань (сейсмограм, велісограм і акселерограм) з різним спектральним складом і максимальними піковими прискореннями.

При побудові АЧХ моделей геологічного середовища інженерно-геологічних районів №1 - 5 в межах території розміщення основних споруд Ташлицької ГАЕС використовувався метод еквівалентного лінійного моделювання реакції ґрунтової товщі на сейсмічні впливи. Поведінка кожного шару ґрунтової моделі при розрахунках задавалася моделлю Кельвіна – Фойгта (в‘язко-пружною). Кожний шар ґрунтової моделі характеризувався такими параметрами, як: потужність шару, швидкості поздовжніх і поперечних хвиль, густиною, нелінійними залежностями модуля зсуву і коефіцієнта поглинання від деформації зсуву. Використання при розрахунках залежностей модуля зсуву і коефіцієнта поглинання від деформації зсуву дозволяють врахувати нелінійну поведінку ґрунтів під час землетрусу.

На рис.2 приведено АЧХ для моделей ґрунтової товщі інженерно-геологічних районів №1 – 5 та їх обвідна.

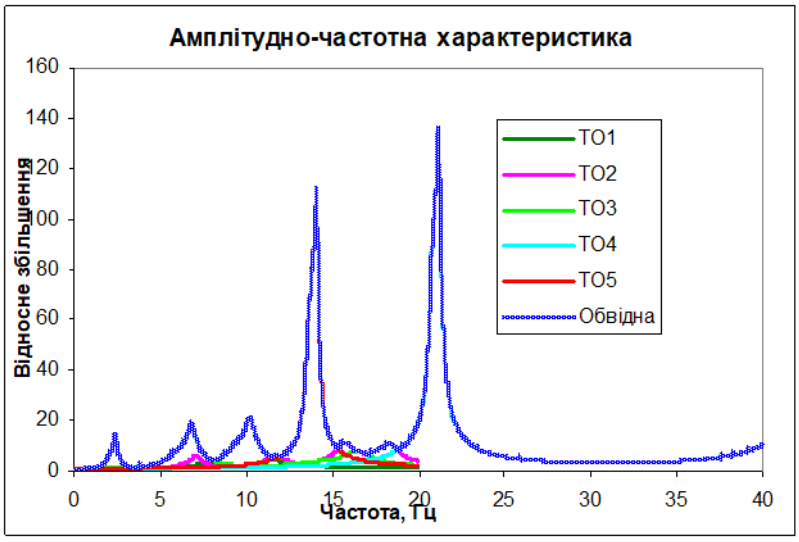

Рис. 2. АЧХ для Т-складової коливань поверхні моделей ґрунтової товщі інженерно-геологічних районів №1-5 виділених в межах території розміщення основних споруд Ташлицької ГАЕС та їх обвідна, для випадку падіння поперечної хвилі знизу на підошву півпростору

АЧХ розраховано для Т-складової коливань, у випадку падіння поперечної хвилі знизу на підошву півпростору під досліджуваним майданчиком для інженерно-геологічних районів №1-5.

З рис.2. видно, що найширшим частотним діапазоном резонансного підсилення коливань локальними ґрунтовими умовами характеризується АЧХ моделі ґрунтової товщі інженерно-геологічного району № II (Ташлицька гребля). Відмітимо також, що АЧХ моделі ґрунтової товщі інженерно-геологічного району № II (Ташлицька гребля) містить найбільший свій максимум в області низьких частот, порівняно з АЧХ інших інженерно-геологічного районів. АЧХ моделі ґрунтової товщі інженерно-геологічного району № IV (днище незатопленої частини Ташлицької балки), виділяється частотним діапазоном резонансного підсилення коливань локальними ґрунтовими умовами в області достатньо високих частот.

На рис. 3 приведено АЧХ моделі ґрунтової товщі інженерно-геологічного району №1 (вододільна рівнина), виділеного в межах території розміщення основних споруд Ташлицької ГАЕС.

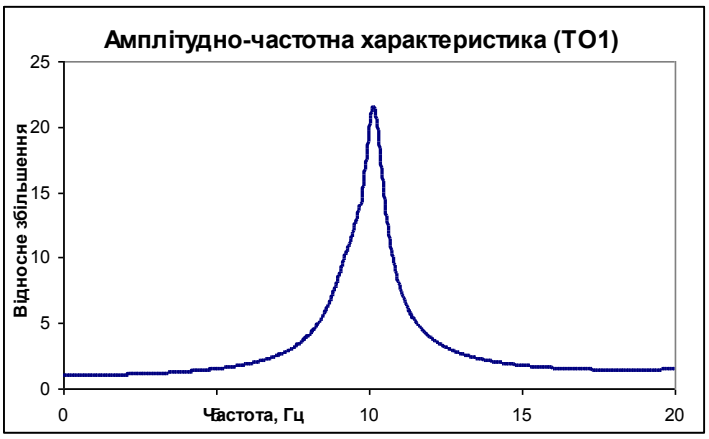

Рис. 3. АЧХ для Т-складової коливань поверхні моделі ґрунтової товщі інженерно-геологічного районів №1 (вододільна рівнина), виділеного в межах території розміщення основних споруд Ташлицької ГАЕС, для випадку падіння поперечної хвилі знизу на підошву півпростору

З рис. 3 видно, що АЧХ моделі ґрунтової товщі інженерно-геологічного району №1 (вододільна рівнина) характеризується одним максимумом резонансного підсилення сейсмічних коливань локальними ґрунтовими умовами з частотним діапазоном від 9,32 Гц до 10, 74 Гц.

На рис. 4 приведено АЧХ моделі ґрунтової товщі інженерно-геологічного району району № II (Ташлицька гребля), виділеного в межах території розміщення основних споруд Ташлицької ГАЕС.

Рис. 4. АЧХ для Т-складової коливань поверхні моделі ґрунтової товщі інженерно-геологічного районів району № II (Ташлицька гребля), виділеного в межах території розміщення основних споруд Ташлицької ГАЕС, для випадку падіння поперечної хвилі знизу на підошву півпростору

АЧХ ґрунтового середовища інженерно-геологічного району № II (Ташлицька гребля), представлена на рис.3, характеризується широким частотним діапазоном резонансного підсилення коливань локальними ґрунтовими умовами від 2,08Гц до 19,26Гц. В зазначеному частотному діапазоні спостерігаються чотири максимуми, з яких перший та останній мають досить великий коефіцієнт підсилення. Тому найбільші підсилення сейсмічних коливань локальними ґрунтовими умовами інженерно-геологічного району № II (Ташлицька гребля) можуть спостерігатись в частотних діапазонах 2,08 - 2,54 Гц та 14,74-19,26 Гц. Максимуми з незначним коефіцієнтом підсилення спостерігаються в частотному діапазоні 6,32 – 7,64 Гц та 10,66 – 19, 26 Гц.

На рис. 5 приведено АЧХ моделі ґрунтової товщі інженерно-геологічного району району № III (греблі верхньої водойми Ташлицької ГАЕС), виділеного в межах території розміщення основних споруд Ташлицької ГАЕС.

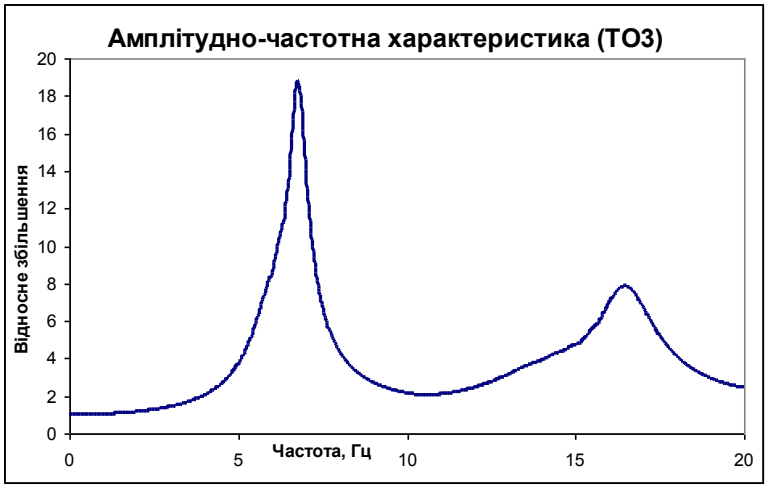

Рис. 5. АЧХ для Т-складової коливань поверхні моделі ґрунтової товщі інженерно-геологічного району № III (греблі верхньої водойми Ташлицької ГАЕС), виділеного в межах території розміщення основних споруд Ташлицької ГАЕС, для випадку падіння поперечної хвилі знизу на підошву півпростору.

АЧХ ґрунтового середовища інженерно-геологічного району № III (греблі верхньої водойми Ташлицької ГАЕС), характеризується частотним діапазоном резонансного підсилення коливань локальними ґрунтовими умовами від 6,12 Гц до 18,12 Гц. В зазначеному частотному діапазоні спостерігаються два максимуми, з яких перший має значно більший коефіцієнт підсилення. Тому найбільші підсилення сейсмічних коливань локальними ґрунтовими умовами інженерно-геологічного району № III (греблі верхньої водойми Ташлицької ГАЕС), можуть спостерігатись в частотному діапазоні 6,12 – 7,26 Гц. Другий максимуми з незначним коефіцієнтом підсилення спостерігається в частотному діапазоні 14,04 – 18,12 Гц

На рис. 6 приведено АЧХ моделі ґрунтової товщі інженерно-геологічного району району № IV (днище незатопленої частини Ташлицької балки), виділеного в межах території розміщення основних споруд Ташлицької ГАЕС.

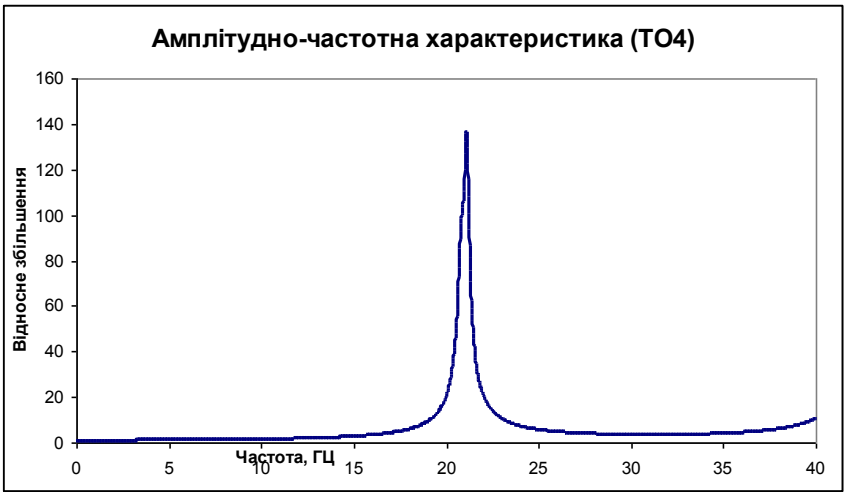

Рис. 6. АЧХ для Т-складової коливань поверхні моделі ґрунтової товщі інженерно-геологічного району № IV (днище незатопленої частини Ташлицької балки), виділеного в межах території розміщення основних споруд Ташлицької ГАЕС, для випадку падіння поперечної хвилі знизу на підошву півпростору

З рис. 6. видно, що АЧХ моделі ґрунтової товщі інженерно-геологічного району № IV (днище незатопленої частини Ташлицької балки), характеризується одним чітким максимумом резонансного підсилення сейсмічних коливань локальними ґрунтовими умовами. Максимум має досить великий коефіцієнт підсилення сейсмічних коливань, та вузький частотний діапазон з частотним діапазоном від 20,66 Гц до 21,36 Гц.

На рис. 7 приведено АЧХ моделі ґрунтової товщі інженерно-геологічного району № V (засипана ділянка Ташлицької балки), виділеного в межах території розміщення основних споруд Ташлицької ГАЕС.

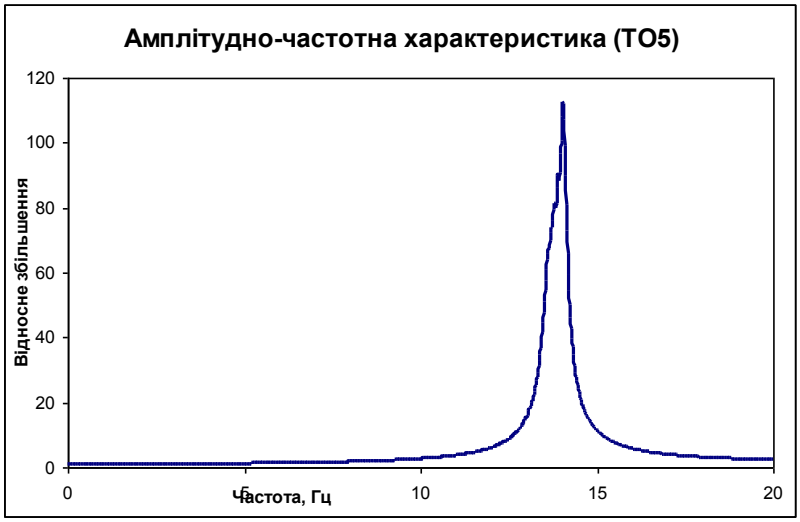

Рис. 7. АЧХ для Т-складової коливань поверхні моделі ґрунтової товщі інженерно-геологічного № V (засипана ділянка Ташлицької балки), виділеного в межах території розміщення основних споруд Ташлицької ГАЕС, для випадку падіння поперечної хвилі знизу на підошву півпростору

АЧХ моделі ґрунтової товщі інженерно-геологічного району № V (засипана ділянка Ташлицької балки), характеризується одним чітким максимумом резонансного підсилення сейсмічних коливань локальними ґрунтовими умовами. Максимум має досить великий коефіцієнт підсилення сейсмічних коливань, та вузький частотний діапазон з частотним діапазоном від 13,54 Гц до 14,22 Гц.

Проаналізувавши всі розраховані частотні характеристики моделей ґрунтових товщ досліджуваних ділянок, можна зробити висновки, що коефіцієнт підсилення має значний розкид. Це, очевидно, є наслідком нелінійної поведінки ґрунтів і їх фільтруючих властивостей. Можна стверджувати, що пошуки одної чіткої залежності, яка б пов'язувала тип ґрунту, чи його категорію за сейсмічними властивостями, з очікуваними максимальними прискореннями є не продуктивними. Така залежність буде відображати лише загальні тенденції. При прогнозуванні небезпечних (для конкретних об'єктів) сейсмічних впливів необхідно будувати частотні характеристики, які описують їх складну залежність від будови ґрунтових умов, від впливу реологічних властивостей кожного із шарів ґрунту під досліджуваними майданчиками при сейсмічних впливах різної величини.

Висновки.

В роботі наведено результати моделювання сейсмічної реакції ґрунтової товщі в основі Ташлицької гідро-акумулюючої станції. По розрахованих частотних характеристиках ґрунтової товщі таксонометричних одиниць, виділених в межах досліджуваної території, визначено резонансні частоти, на яких спостерігається значне підсилення сейсмічних коливань локальними ґрунтовими умовами. Наведено короткий аналіз отриманих результатів. Показано, що в межах однієї території, ділянки з відмінною геологічною будовою суттєво відрізняються за фільтруючими властивостями відносно сейсмічних коливань. Частотний діапазон можливого підсилення сейсмічний коливань для кожної таксонометричної одиниці різний. Таким чином, для визначення сейсмічної вразливості основних споруд в межах території Ташлицької гідро-акумулюючої станції, необхідно враховувати власні частоти споруди і частотний діапазон можливого підсилення сейсмічних коливань ґрунтами ділянки її розташування.

Частотні характеристики ґрунтових комплексів використано при генеруванні наборів розрахункових акселерограм для моделювання сейсмічних впливів від місцевих землетрусів і землетрусів зони Вранча на основні споруди Ташлицької ГАЕС

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AGRICULTURAL SCIENCES

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ЕФЕКТИВНІСТЬ ЗАСТОСУВАННЯ РІЗНИХ СПОСОБІВ БОРОТЬБИ З ВАРОАТОЗОМ БДЖІЛ

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EFFECTIVENESS OF APPLICATION OF DIFFERENT METHODS OF CONTROL OF BEE VAROATOSIS

Анотація.

У статті досліджено ефективність використання зоотехнічного та хімічного способів боротьби з варроатозом. Обробку бджіл проводили щавлевою кислотою та біпіном. Мінімальне ураження бджолиних сімей на початку активного сезону була у лютому місяці і складала у середньому 1,86%, максимум – у кінці даного сезону (вересень-жовтень) – у середньому 21,9%. Найбільша закліщеність спостерігалась у трутневому розплоді, починаючи з травня по серпень місяць (з 3,54 до 27,2%), бджолині сім'ї під час весняної ревізії були середньої сили, по 7,2-7,4 вуличок бджіл. Використання зоотехнічного способу боротьби з варроатозом бджіл призводить до зниження закліщеності до 1,6 % восени, за обробки щавлевою кислотою закліщеність бджіл у кінці сезону склала 0,5%, біпіном – 0,4%. Найефективнішою виявилась обробка бджіл біпіном – закліщеність з весни до осені знизилась на 2,8%. У травні місяці відмічено збільшення розвитку бджолиних сімей у другій групі на 14,3% і третій – на 4,8%; червні – на 8,2 і 11,8%; липні – на 11,4 і 14,1%, серпні – на 9,1 і 19,1% та вересні місяці – на 6,7 і 9,3% відповідно, порівняно з контролем. У сім'ях, де обробку від вароатозу проводили біпіном, медова продуктивність більша на 0,9 кг, або на 3,7% порівняно з обробкою щавлевою кислотою. Сім'ї, в яких проводилась обробка щавлевою кислотою (друга група), порівняно з третьою групою (обробка біпіном), принесли обніжжя на 2,2%, виробили воску – на 3,7% більше.

Abstract.

The article investigates the effectiveness of zootechnical and chemical methods of combating varroasis. Treatment of bees was performed with oxalic acid and bipin. The minimum number of bee colonies at the beginning of the active season was in February and averaged 1.86%, the maximum - at the end of this season (September-October) - an average of 21.9%. The greatest congestion was observed in the drone brood, from May to August (from 3.54 to 27.2%), bee families during the spring audit were of medium strength, 7.2-7.4 streets of bees. The use of a zootechnical method to control varroasis of bees leads to a decrease in infestation to 1.6% in autumn, with oxalic acid treatment the infestation of bees at the end of the season was 0.5%, bipin - 0.4%. Bipine treatment of bees proved to be the most effective - congestion decreased by 2.8% from spring to autumn. In May, there was an increase in the development of bee colonies in the second group by 14.3% and the third - by 4.8%; June - by 8.2 and 11.8%; July - by 11.4 and 14.1%, August - by 9.1 and 19.1% and September - by 6.7 and 9.3%, respectively, compared with the control. In families where treatment for varroasis was performed with bipin, honey productivity was higher by 0.9 kg, or 3.7% compared to treatment with oxalic acid. Families treated with oxalic acid (the second group), compared with the third group (treated with bipin), brought a drop of 2.2%, produced wax - 3.7% more.

Ключові слова: *вароатоз, закліщеність, біпін, зоотехнічний спосіб, щавлева кислота, продуктивність*

Keywords: *varroasis, congestion, bipin, zootechnical method, oxalic acid, productivity*

Introduction. Ukraine is one of the leading countries with developed beekeeping, producing 4-5% of the world's honey. The volume of honey production is directly affected by the number of bee colonies, which has decreased in recent years. In Ukraine, there are more than 400,000 beekeepers who keep more than 3 million bee colonies [18, 20].

In recent years, beekeepers have suffered significant losses due to the spread of diseases, and one of the obstacles to the development of beekeeping continues to be varroasis. Nowadays, bee disease is becoming more common, and in the absence of timely and proper treatment often lead to the death of bees. This disease is registered annually in almost all regions and is quite difficult to eradicate. The degree of infestation of bee colonies by the varroa mite in Ukraine is from 0.1 to 20%. The International Epizootic Bureau of Varroasis has included quarantine diseases of bees in list B. Therefore, the number and productivity of their bee colonies depends on how well beekeepers control the spread of varroasis in their apiaries [8].

Varroa is affected by larvae, pupae and adults of

the bee family, which is caused by the parasitic mite Varroa jacobsoni. Infected bee colonies are the source of infection. The largest number of parasites is found on young bees and drones. The varroa mite is transmitted from one family to another by bees during theft, drones during flight, when healthy bees come into contact with sick honeybees, when the affected brood is moved to healthy families, near watering holes, and apiaries roam. During the active beekeeping period, the main place of concentration of the mite is located on the printed brood and beehives. Drone brood, compared to the brood of worker bees, is affected by 7-15 times more [4, 14].

Fig. 4. Mite on imago and drone brood

The parasitism of the mite on the bee pupa causes various disorders in its body. By parasitizing on adult bees, female mites cause them to weaken. In families affected by ticks, flight activity is reduced and, consequently, medical productivity is reduced. By parasitizing on bee brood, mites cause significant changes in its metamorphosis, due to which defective bees emerge from the cells. The greatest changes occur in the second period of development of the larval stage of the bee. Affected bees are much smaller in size and lighter in weight. Their body contains less protein and fat. Abdominal shrinkage and lack of wings in worker bees and drones are often observed [6, 9].

External signs of the disease in the bee family appear after 2-3 years of mite infestation and when more than 20% of bees are affected. A slight defeat by the varroa mite does not significantly weaken the strength of the family and significantly reduce its productivity [12]. With a strong invasion, especially in autumn, the brood is variegated, part of the caps over the printed brood failed, some holes in the caps of irregular shape, dead larvae and pupae are at different stages of decomposition, and putrefactive mass is easily removed from the cell. The infested bee family does not provide itself with food, weakens sharply and, as a result, dies, especially after the autumn replenishment of food supplies with sugar [4].

Winter sick bees do not form a club well, are restless, there are cases of defecation from feces inside the hive, they have an underdeveloped fat body. Severely affected by varroasis bees die during the winter or weaken rapidly [7].

The beekeeper can determine the affliction of apiaries with varroasis, as well as the effectiveness of the applied anti-varroasis drugs by controlling the rash of ticks. To have complete information on the infestation of bees with varroasis and the effectiveness of the veterinary drugs used, the beekeeper must control the tick rash in 20% of families in the apiary or in every 5th family. Determination of congestion should be performed three times a year. Ticks are counted for the first time in the winter, because part of the tick population dies in winter and falls to the bottom of the hive, which is clearly visible among other debris in the family. Undersea with beehive debris of each hive is sifted on a paper sheet through a sieve with holes of 3-4 mm. Then use a magnifying glass to count the number of dead females of the varroa mite. During the winter, the natural mortality among varroa mites is about 10-30%. If there are several ticks in the winter garbage, it is a low incidence of varroasis in the family, a few dozen - medium, a few hundred - strong.

The family is assessed for the second time in the summer after the main medical collection (late July-early August) after the control of the varroa mite. The

degree of family infestation is assessed by calculating the average daily mite rash in the last two weeks of July. If the daily rash of dead ticks is five or more, it indicates a strong defeat of the family by varroasis. Therefore, the beekeeper should start anti-varroa treatments as soon as possible in the fall, because during this period there will be about 3-4 thousand ticks in the family. In families without brood, the average daily mite rash should not exceed 0.5 mites per day. If the tick rash is large, then antivaroatous treatments begin to perform immediately after the last pumping of honey. The third time the tick rash is controlled in late September [15].

Measures to control the pathogen, Varroa mite, are improving from year to year, but it has an extraordinary ability to adapt to most drugs used against it [3].

Many methods and means of combating varroasis have been developed in the world practice of beekeeping [16, 17]. To overcome varroasis, treatment should be comprehensive, using control methods so that they are effective and at the same time not harmful to humans and bees themselves. To control the varroa mite, beekeepers often use the zootechnical method, oxalic acid and bipin.

Zootechnical methods of control of varroa mite: use of building frames; formation of layers with closed brood; use of building frames with open drone brood; artificial swarms [2, 11].

By creating a breeding break in the family, the number of cells available for mite reproduction can be significantly affected. This break can be achieved by isolating or removing the uterus from the family for about 3 weeks. During this time, all the brood is born, so the mites move from the cells to adult bees. This approach alone or in combination with chemical treatment can affect the growth of the varroa mite population [21].

Varroa mites have a higher reproductive rate in the brood of drones than in the brood of worker bees, due to the longer period after sealing, which allows the mites to give birth in the cells of worker bees only 1.3-1.4 pieces. per cell, and 2.2-2.6 pcs. offspring in drone cells. In addition, the period of infection of drone brood is 40-50 hours, in the brood of worker bees - 15-30 hours [1].

In recent years, the most effective against varroa mites have been the treatment of bee colonies with chemicals in the barren autumn-winter period. At this time, the bee families finish growing the brood and the mite turns into bees. There are many of them, but the most popular against ticks are methods using acids (oxalic, lactic, formic), as well as drugs with different active ingredients [10, 13].

The fight against varroasis requires significant financial costs, which consist of organizational and economic, veterinary and zootechnical measures. The difficulty in combating varroasis is primarily that at all stages of development, some adult mites are in cells with sealed drone and bee brood [19]. At present, various foreign and domestic chemicals have been developed to control the varroa mite. However, only the integrated use of various drugs and zootechnical measures can successfully overcome varroasis in apiaries [13].

In connection with the above, the urgent task of beekeeping is the timely detection of the pathogen, as well as the organization of comprehensive measures to control the mite Varroa jacobsoni.

The aim of the research was to determine the impact of various measures to combat bee varroasis on the biological parameters of queen bees, the development of bee colonies and their productivity.

Material and methods of research. A study of the effectiveness of zootechnical biological methods and chemical acaricides in the control of bee varroasis was conducted on bee families of the Ukrainian steppe breed.

Experimental groups were formed by the method of analog groups. For the experiment at the end of March 2018, three groups of bee families were formed, 5 families in each. When forming groups of bee families, the following were taken into account: the strength of the family, the amount of fodder stocks, the number of printed brood and the number of bee colonies.

The study of the effectiveness of the use of comprehensive measures in the fight against varroasis of bees was carried out using generally accepted methods. According to the scheme of the experiment (Table 1) to control varroasis in bee colonies of the control group during the spring-summer period used a zootechnical method, for which the drone brood was removed every 12 days.

Table 1

The scheme of the experiment

Group	Number of families	Means to combat varroasis of bees
1- control	5	Zootechnical method
2 – experimental	5	Zootechnical method + oxalic acid
3- experimental	5	Zootechnical method + bipin

The bees of the family of the second experimental group, in addition to using a zootechnical method to control varroasis, were additionally treated with oxalic acid in two periods per season: after the spring audit (in the third decade of April) and after pumping honey of the main honey harvest (in the last decade of August). Because oxalic acid does not penetrate through the caps, it is most effective in periods without brood, which makes it useful in the early spring [10]. Oxalic acid was used at an ambient temperature of not less than 14 0C in the form of an aqueous solution. The solution was prepared at the rate of 20 g of pure crystalline acid per 1 liter of boiled water cooled to 36 0C. With the help of a sprayer "Rosinka" bees were sprayed on the hives, making sure that the solution does not fall on the open brood. To do this, the honeycombs were pushed to the width of two frames and the solution was directed from top to bottom, as well as to the bees that were on the walls and bottom of the hive. In April and August, the treatment was performed again after 7 days.

The bees of the family of the third experimental group after the end of honey collection and the release of the last brood were additionally treated with bipin 2 times in late October, after 7 days. Bipin was used as an aqueous suspension - one ampoule (1 ml of concentrate) was dissolved in two liters of clean water. The bees were sprayed with a syringe at the rate of 10 ml per bee street. During the spring-summer period, drone brood was regularly removed from bee colonies of the third experimental group every 12 days, similarly to families from the first and second groups.

In the experiments, before and after treatment, bees were sampled from each family and the level of entrapment was determined by the Petrov method. According to this method, 50-100 bees were placed in a glass jar filled with hot soap solution and stirred periodically for several minutes. After the bees floated to the surface and the mites settled to the bottom of the jars, the solution was carefully drained with the bees in each sample and the sediment was examined by counting the number of mites. Counting the number of bees and mites, determined the percentage of congestion. Clogging up to 2% was considered small, up to 4% - medium, more than 4% - strong.

The level of congestion was also determined in the brood. To do this, the lids of 100 cells with brood were cut with a heated sharp knife and examined the elongated larvae and cells. After removing the larva from the cell, counted the number of mites that are on it. During the examination, the number of mites that are directly in the cell was counted. Then the obtained data of brood larvae were summed with the data of adult bee infestation and the average value of bee colonies was determined.

For preliminary diagnosis of the presence of bee colonies for varroasis in the winter-spring period, after exposing the bees from the wintering ground and the first cleaning flight of bees, the presence of mites in samples of plague collected with wax caps and debris from the bottom of the hive.

The strength of bee colonies was determined by the number of streets occupied by bees at the end of March, during the spring audit of bees and at the end of October, during the autumn audit of bee colonies. It was assumed that the standard honeycomb size of 435x300 mm contains 250 g, or 2500 bees, which corresponds to one street. The outer parts of the extreme frames were taken as 0.5 streets. Multiplying the number of streets occupied by bees by the number of bees corresponding to one street determined the strength of the families.

The presence of brood in the nest was determined by two indicators: the number of frames on which the brood is placed and the absolute number of brood in the family per cell. The number of brood during the spring audit of bee colonies was determined using a frame-grid divided into squares of size 5x5 cm. One square of such a grid contains 100 bee or 75 drone cells. Determining the number of squares occupied by the brood, multiplied by the corresponding number of brood (100 or 75).

The yield of marketable honey was determined by the amount of honey pumped from each bee family during the beekeeping season.

Wax productivity of families was determined by the number of frames of rebuilt honeycombs based on honeycomb, which was substituted in bee families regularly, as they rebuilt [5].

Results and discussion. The conducted researches carried out the analysis of extensiveness of defeat of bee families by a varroa mite. Based on the data obtained, four related to the biology of the bee family during the development of the Varroa mite in bee colonies [14].

The first period, from March to May, was associated with the change of overwintering bees, new ones and the beginning of the increase in the number of bees in the families. During this period, the extensive infestation of families with the varroa mite did not exceed 3.27%, which is due to the natural death and rash of mites during the winter and spring.

The second period, from May to August, was characterized by an increase in the number of bees in the families and an increase in the extent of bee infestation by the varroa mite.

The third period (from August to October) was determined by the cessation of uterine oviposition and, accordingly, the growth of the family, the change of summer bees by young ones that go into winter, and the formation of a winter club. At the end of this period, there was a peak in the extent of bee infestation by the varroa mite, averaging 21.9%.

The fourth period - wintering (from October to March). This period was characterized by the absence of brood. Therefore, varroa mites did not reproduce and only female mites were present in the families.

The extent of adult invasion reached critical values during the formation of winter generation of bees (August-September) and therefore posed a threat to the viability of bee colonies in the autumn and family development in the spring of next season (Fig. 1).

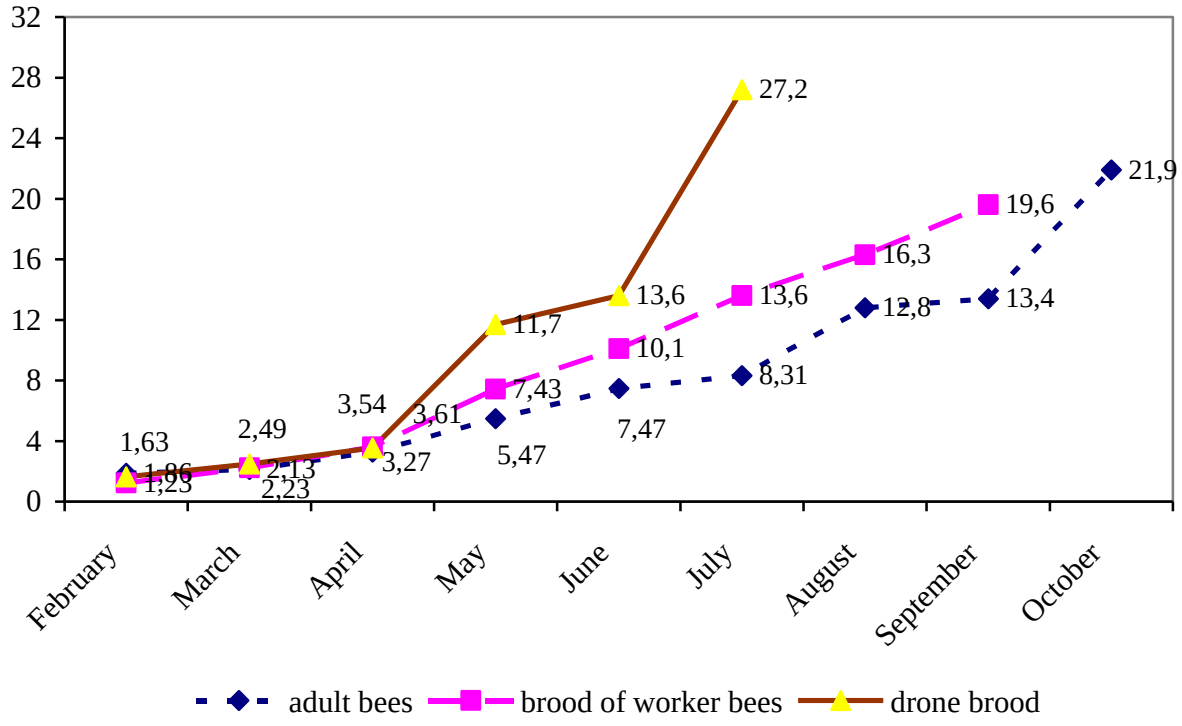

Fig. 1.
Dynamics of development of extensiveness of varroasis infestation in bee colonies during the active season,%

When studying the dynamics of development of varroasis, it was found that the minimum damage to bee colonies was in February and averaged 1.86%, the maximum - in late September-early October - an average of 21.9%.

Mass development of the Varroa mite occurs in the summer, which feeds and develops mainly on drone brood. The highest infestation was observed in drone brood from May (3.54%) to August (27.2%). Congestion of drone brood in March, compared with February, increased by 0.86 percentage points. Then in each subsequent place compared to the previous increase was as follows: in April - by 1.05 percentage points, in May - by 8.16 percentage points, in June - by 1.9 percentage points, in July - by 13 , 6 p.p. There have been no drone broods in families since August, so this figure has not been studied this month.

The congestion of brood of worker bees had a similar dynamics. At the beginning of the active season, this figure was almost on a par with the data of drone brood. Starting from April, the number of mites on brood of worker bees during the year increased (from 3.54% to 19.6% in September). However, the increase in the larvae of worker bees was gradual, in May - by 3.82 percentage points, in June - by 2.67 percentage points, in July - by 3.5 percentage points, in August - by 2.7 percentage points. .p., September - by 3.0 p.p.

Invasive disease varroasis in brood of worker bees developed less than in drone, but more than in adult bees. If at the beginning of the season in the first three months this figure was almost the same, then in the following months there was a noticeable difference in favor of brood of worker bees. This is due to the fact that in the summer months of the active season, the mite develops mainly on the drone brood. In May, the reduction in brood entanglement of worker bees was by 4.27 percentage points, in June - by 3.5 percentage points, in July - by 13.6 percentage points.

At the end of the active season, the uterus reduces egg-laying, ie the brood is smaller, and the mite increases in adults. And at the end of the active season (September) in bee colonies congestion is 21.9%, an increase over the previous month by 8.5 percentage points.

Determining the level of infestation of bee colonies with varroa mites is the most important component of measures to treat bees from varroasis. Mite infestation of more than 3% causes a significant departure of their bees. If bees are affected by ticks in autumn, more than 10% have no guarantee of their survival, even if the bees are treated with anti-varroa drugs. If in July the degree of mite infestation of bees is less than 1%, treatment against mites can be postponed until the fall, after pumping out the honey. If in the beginning of summer till October the defeat of bees by a tick in families makes 5-6%, their number increases depending on force of families. In particular, in weak families up to 28%, in strong - up to 20%, ie the number of mites increases 4-5 times over the summer.

Treatment of bees for varroasis involves primarily reducing the number of varroa mites to a safe level for bees. In our experiment conducted in the apiary of the farm in the beekeeping season of 2018, the fight against varroasis was carried out according to the scheme during the months of May-August (Table 2).

Table 2

Scheme of control of bee varroasis

Types of work	Months of the year																												
	I			II			III			IV			V			VI			VII			VIII			IX			X	
	Decade																												
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1
Rest period, hibernation of bees	■	■	■	■	■	■	■	■																							
Exhibition of bees from the wintering ground									■	■	■																				
Oxalic acid treatment (group 2)												■	■														■	■			
Stimulating feeding for bee growth												■	■																		
Zootechnical control measures (1, 2, 3 groups)													■	■	■	■	■	■	■	■	■	■	■								
Bipin treatment (group 3)																															■

Treatment of bee colonies of the second experimental group with oxalic acid was carried out in two periods: spring and late summer, and the third experimental group (bipin treatment) - only in autumn. All groups of experimental families for their removal from the winter, according to the results of the spring audit, are characterized by the same indicators of strength, number of feed stocks, printed brood and the level of congestion (Table 3).

Table 3

Characteristics of experimental groups of bee colonies, group average

Group	Number of families, pieces	The strength of the family, the cells	Amount of feed, kg	Number of printed brood, pcs.	Clogging of bee colonies,%
1- control	5	7,4	6,7	830	3,1
2 – experimental	5	7,3	6,5	840	3,2
3- experimental	5	7,2	6,8	820	3,1

As can be seen from Table 4, bee families during the spring audit were of medium strength, 7.2-7.4 bee streets in each family, and had an average of 4 squares of 5x5 cm on each frame on two hives printed brood.

After the equalization period, on April 24, the second experimental group was treated with oxalic acid. This treatment was repeated after 7 days at a temperature of 14-15 0C. Before and after treatment of bee colonies, the degree of Varroa mite infestation was determined. The degree of infestation of bee colonies by the varroa mite for this period was average and amounted to 3.1-3.2% with an intensity of invasion of 1-2 specimens.

From May to the end of August, the following zootechnical measures to control varroasis were carried out in the apiary in all bee families according to the scheme:

- the use of wax frames, on which bees rebuild drone cells, and after sealing the drone brood removed it from the nest with mites every 12 days;

- the use of mesh subframes to catch mites, which fell from the bees to the bottom of the hive and rarely climbed back to the bees.

The intensity of the use of zootechnical and chemical agents to combat varroasis can be judged from the data in table 4.

Table 4

Degree of defeat of bee families,%

Group	The degree of damage to bees Varroa J.,%				± before the start of the season,%
	Date of examination				
	31 March	24 April	6 September	18 October	
1- control	3,1	3,1	1,7	1,6	-1,5
2 - experimental	3,2	1,2	1,8	0,5	-2,7
3- experimental	3,2	3,2	1,7	0,4	-2,8

During the summer, the number of mites in bee colonies does not decrease, and they focus mainly on drone brood, so it was removed from the hives of all three groups every 12 days. This zootechnical measure restrained the growth of congestion.

These tables show that the use of only a zootechnical method to control varroasis of bees in the first control group leads to a reduction in congestion by almost half (from 3.1% in spring to 1.6% in autumn). However, the zootechnical method is not effective enough to remain the only means of controlling varroa mites. The use of chemicals to combat invasive disease in the experimental groups had a significant effect on reducing bee infestation. Thus, the treatment of bees of the second experimental group with oxalic acid had a positive effect on their recovery. The infestation of these bees at the end of the beekeeping season was only 0.5%, which is 2.7% less than the initial infestation rate (at the end of March).

Treatment of bee colonies of the second experimental group with oxalic acid (2 times in spring and 2 times in autumn) significantly reduced the rate of congestion. Immediately after treatment of families with this drug in the spring congestion decreased to a minimum (from 3.2 to 1.2%), but in the process of development of bee colonies congestion increased again and on September 5 amounted to 1.8%, and after autumn treatment with oxalic acid decreased again and amounted to 0.5%.

The treatment of bees of the third experimental group with bipin in the beginning of October proved to be the most effective. As a result of treatment with this drug, the congestion decreased by 2.8% compared to the spring period.

Thus, due to the use of chemicals to combat varroasis by the end of the beekeeping season it was possible to reduce the rate of congestion to 0.4-0.5% against 1.6% using only zootechnical control measures.

Thus, as a result of the use of various means of combating varroasis in the complex (zootechnical + chemical) gives a relatively better effect than the use of only zootechnical means.

However, it should not be forgotten that chemicals to some extent affect the health of bees and the quality of bee products. Therefore, with such a relatively low congestion of families in the spring, you can avoid treating them with chemicals during this period (Table 5).

Table 5

Changing the enclosure of bee colonies as a result of the use of chemicals (autumn treatment)

Group of bee families	The name of the drug used to treat bees	Clogging,%	
		before processing	after processing
2 – experimental	Oxalic acid	1,8	0,5
3- experimental	Bipin	1,7	0,4

It is better during the spring-summer period to regularly, every 12 days, remove drone brood and treat families in the fall with bipin or oxalic acid.

During the beekeeping season, the rate of increase in the strength of bee colonies of different groups was not the same and almost did not depend on the means of combating varroasis, and varied greatly from period to year (Table 6).

Table 6

Changes in the strength of experimental families during the beekeeping season

Date of observation	Number of honeycombs occupied by bees			Number of bees, thousands		
	group of bee families			group of bee families		
	1	2	3	1	2	3
31 March	7,4	7,3	7,2	18,5	18,3	18,0
24 April	6,5	6,5	6,4	16,4	16,4	16,0
15 May	10,5	12	11	26,3	30,0	27,5
16 June	17,0	18,4	19	42,5	46,0	47,5
15 July	18,4	20,5	21	46,0	51,3	52,5
20 August	11	12	13,1	27,5	30,0	32,8
11 September	7,5	8,0	8,2	18,8	20,0	20,5

The production of brood in bee colonies is best determined during the beekeeping season by the strength of the family, ie by the number of streets well populated by bees. The data of the obtained researches show that the development of experimental families of all groups during the season took place in comparison with the same intensity. In the development of bee colonies, there was a general pattern inherent in the biological properties of bees: after the winter, the strength of the family decreases slightly, then increases, and before the onset of wintering decreases again.

Additional treatment of bee colonies of experimental groups with chemical acaricides against varroasis somewhat affected their development. During the treatment of bees with chemical acaricides, the number of bees in the experimental families was higher since May. In May, the increase in the second group by 14.3% and the third - by 4.8%; June - by 8.2 and 11.8%; July - by 11.4 and 14.1%, August - by 9.1 and 19.1% and September - by 6.7 and 9.3%, respectively, compared with the control. Because additional treatment of bee colonies with oxalic acid and bipin chemicals had a greater effect on varroa mite shedding than only the biological method of removing drone brood, this contributed to better development of bee colonies in the experimental groups.

The various measures to control varroasis used in the experimental apiary during the study period significantly affected the productivity of bee colonies (Table 7).

Table 7

Productivity of bee colonies, on average per 1 family

Month active season	Group		
	1-control	2-experimental	3-experimental
Production of marketable honey, kg	21,5±0,18	23,3±0,47	24,2±0,25
Rebuilt honeycombs, pieces	7,1±0,08	7,6±0,12	7,3±0,14
Produced wax, kg	1,2±0,02	1,4±0,01	1,33±0,02

The highest rates of honey productivity of bee families were in the third group, where per bee family per season received honey by 2.7 kg, or 12.6% more. In the second group, bee colonies produced 1.8 kg, or 8.4% more honey than in the control, but compared to the third group, less than 0.9 kg, or 3.7%.

The bees of the experimental families produced more wax during the reconstruction of the hives. The second experimental group was the best in terms of the number of reconstructed cells. Thus, the advantage in this group was 0.5 pcs. honeycombs more per bee family, or 7.0% compared to the control. When comparing the studied indicator between the experimental groups, the bees of the second group, compared with the third, rebuilt by 0.3 pieces, or 4.1% more honeycombs.

The wax capacity of bees of the second group was higher by 16.6%, the third - by 10.8% against the same indicator of the first group. The advantage between the experimental groups was the second - by 5.3%.

In May, almost the same amount of protein feed was collected from the bee families of the experimental groups - 115.5-118.3 g, in June the indicators already differed between the groups. Thus, the bees of the second group collected 6.8 g, or 6.4% more bee pollen, in June the difference was more significant, in the second group more by 18.8 g, or 17.7%, the third - by 9, 4 g, or 8.9% (Fig. 2).

During the experimental period (from May to July) from bee families of experimental groups col-

lected a larger amount of bee pollen, namely, in the second group 354.6 g, which is 27.2 g, or 8.3%, the third - 347.1 g, which is 19.7 g, or 6.0% more than the first control (327.4 g).

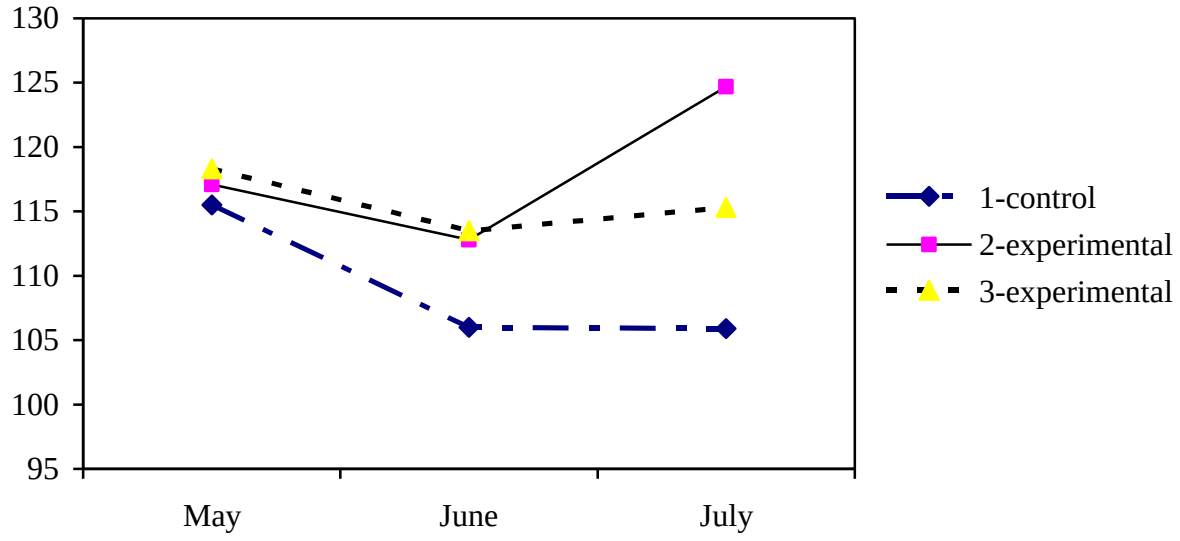

Fig.2. Monthly collection of pollen bees, g

Families treated with oxalic acid (group 2) compared to the third group (bipin treatment) brought 7.5 g, or 2.2% more pollen, into the nest (Fig. 2).

Thus, analyzing the productivity of bee colonies, it can be stated that the congestion of bee colonies from spring to autumn with different methods of treatment against varroasis significantly affected their honey and wax productivity and collection of pollen.

Conclusions. The minimum number of bee colonies in February was 1.86%, and the maximum in late September and early October was 21.9%. The largest congestion in the drone brood, from May to August (from 3.54 to 27.2%). The use of a zootechnical method to control bee varroasis leads to a decrease in congestion by 1.5, with treatments with oxalic acid - 2.7 and bipin - by 2.8%. In May, the development of bee colonies in the second group increased by 14.3% and the third - by 4.8%; June - by 8.2 and 11.8%; July - by 11.4 and 14.1%, August - by 9.1 and 19.1% and September - by 6.7 and 9.3%, respectively, compared with the control. During the season, honey was obtained in the second group by 12.6%, the third - by 8.4% more honey compared to the first group, which did not treat bees with chemical acaricides. From bee families of the second group more pollination was collected, in comparison with control, by 8,3%, the third - by 6,0%. Wax secretion in families of the second group was higher by 16.6%, the third - by 10.8%.

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МОЛОЧНАЯ ПРОДУКТИВНОСТЬ КОРОВ РАЗНЫХ ПОРОД

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DAIRY PRODUCTIVITY OF COWS OF DIFFERENT BREEDS

Аннотация.
В статье показана эффективность молочной продуктивности разных пород коров. Рассматривается влияние внешних характеристик на продуктивность.

Abstract.
The article shows the effectiveness of milk production of different breeds of cows. The influence of external characteristics on productivity is considered.

Ключевые слова: *продуктивность, скот, молочность, выращиваемость, генофонд, климат, коровы.*
Keywords: *productivity, livestock, milk production, rearing, gene pool, climate, cows.*

Айрширская порода коров. Получила свое название в честь региона, где ее начали разводить, – Эйршир, Шотландия, где ее успешно выращивают и сегодня. Выведена при помощи длительного улучшения видов местного скота с последующим скрещиванием с несколькими породами КРС – голландской, гернсейской, девонской и геренфордской породами. Самостоятельной породой Айширская объявлена в 1862 году. Этот КРС предпочитают суровый климат жаркому – потому широко распространен в Канаде, США, Финляндии, а также в Северо-Западном и Центральном округах России, занимающей второе место по наличию популяции, а самая большая общая численность айрширов имеется в Финляндии. Тем не менее, разводят таких коров и в Австралии [1]. Голштинская или голштино-фризская порода коров. Самый распространенный вид КРС в мире. Впервые появилась на территории Нидерландов. Была ввезена в Северную Америку в 1852 году, затем для повышения молочной продуктивности была скрещена с немецким крупным рогатым скотом. В США и Канаде буренок совершенствовали в основном по величине удоя и живому весу при несильном отборе по жирномолочности. Долгое время носила название голштино-фризской в связи со слиянием Ассоциаций заводчиков соответствующих видов. Затем, в 1983 году, ее название сократили до нынешнего – голштинская. В России появилась в 1956 году: здесь разводят преимущественно черно-пестрых коров этого направления, однако, есть и пестро-красные. Их получили при помощи скрещивания голштинских быков с коровами симментальской породы [2].

Джерсейская порода коров. Считается одной из самых старых и жирномолочных культурных разновидностей. Получила свое имя в честь одного из Нормандских островов – Джерси, где ее начали разводить как племенной скот, используя генетический материал нормандского и британского КРС. Долго сохраняла свою чистокровность в связи с запретом властей на экспорт племенного скота. Племенную книгу джерсейской породы завели в 1866 году. За пределы своей родины джерсейские животные были впервые вывезены только в начале XIX века: сначала – в Англию и США, а позже – в Австралию, Африку и Новую Зеландию, где живут и сегодня. Помимо этого, широкое распространение получили в Дании, Канаде и Франции, а также в Воронежской и Московской областях России. Черно-пестрая порода коров. Советский крупный рогатый скот молочного направления и высокой, в том числе мясной, продуктивности. Имеет характерный окрас, за что и получила свое название. Иногда ее ошибочно отождествляют с голштинской породой. В начале 1930-х годов животные черно-пестрого окраса завозились в СССР из Германии и стран Прибалтики. Также эту породу получали путем скрещивания местных коров с быками, поставляемыми из Нидерландов, а окончательно ее утвердили в 1959 году после дифференциации животных с красным окрасом. К концу 1970-х годов численность животных черно-пестрого окраса превысила 10 млн голов [3]. Симментальская порода коров. Этот КРС считается одним из самых древних в мире. В V веке его генетических предков привезли на территорию Швейцарии, затем скот постоянно совершенствовался вплоть до второй половины XX века. Животные хорошо приспособлены к акклиматизации, вследствие чего получили широкое распространение во всем мире. Впоследствии уже ее генетический материал использовался для получения многих других пород – болгарской красной, венгерской пестрой, словацкой красно-пестрой, сычевской, монбельярдской, французской симментальской, флекфи, и других. В России известна с

XIX века, а в настоящее время ее разводят в 36 регионах [4].

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AGROECOLOGICAL ASSESSMENT OF SOIL CONDITION OF KHMILNYTSKYI DISTRICT OF VINNYTSIA REGION

Abstract.

The aim is to assess the agrochemical condition of soils and justify measures to reduce their pollution by heavy metals within the Khmilnytskyidistrict.In accordance with the set goal it is necessary to solve the following tasks: to take soil samples for laboratory tests; to carry out agrochemical assessment of soils of the settlement; to study the intensity of soil contamination with heavy metals (lead, cadmium); to investigate the level of concentration of microelements-toxicants in soils (zinc, copper);to optimize measures to reduce the intensity of soil contamination with heavy metals and trace elements, as well as measures to improve agro-ecological indicators.According to research, chernozems are highly degraded medium loam, which predominate in the Khmilnytskyidistrictare characterized by neutral acidity, humus content is high, so these soils are enriched with plenty of organic matter, which is positive for their use in agriculture.

According to soil studies on the content of mobile forms of trace elements, it can be concluded that the content of boron and manganese is within normal limits. The sulfur content is low and the iron content is very low. Magnesium content is also increased.

Analyzing soil contamination with lead, cadmium, zinc and copper, we note that their content was lower than the MPC by 8.1 times, 5.38, 21.4 and 5.0 times, respectively. The highest content of heavy metals in the soil was observed for zinc, compared to lead, cadmium and copper, it was 1.44, 8.23 and 1.78 times higher, respectively.The hazard ratio of heavy metals was the highest for copper. Introduction of integrated agriculture, based on a combination of positive aspects of alternative and intensive farming systems.

It is necessary to optimize the structure of land and sown areas, to introduce soil protection technologies for growing crops, to strengthen state control over land use, to provide funding for land protection and soil protection measures.

Keywords: *monitoring, soil, concentration, heavy metals, quality, indicators, trace elements, humus.*

Man in agricultural activities, using land, water, plant, animal and energy resources, provides himself primarily with food, while creating a greater impact on nature than in any other activity.

Producing enough food to provide the world's population with food is one of many complex, interdependent problems. Another important problem is the quality of food, the presence in it of the body's necessary proteins, vitamins, trace elements, etc.It is also important to manage the world's agricultural systems, which should be done in such a way as to minimize the harmful effects on the environment of food production and distribution.

Soil is a major, independent component of the natural environment and the biosphere in general, a limited, indispensable and difficult to renew natural resource that performs important functions: productive, environmental, social and information. Currently, the issues of the role and importance of soils, their balanced use, management, protection and combating degradation have reached a global level [2].

Carried out an assessment of the agrochemical condition of soils and justification of measures to reduce their pollution by heavy metals within the Khmilnytskyidistrictof Vinnytsia region [7].

Soil is the basis for harvesting crops, the main wealth on which our existence depends. It is the main means of agricultural production, the main source of food [1].

The importance of improving the efficiency of land use in agriculture, taking into account the environmental factor, as well as the lack of research on this issue determine the relevance of this study.

However, the problem of environmentally safe land use is insufficiently studied, especially in terms of the use of soil protection methods of tillage, which have a positive effect on its quality and reduce the cost of growing crops [3].

Agriculture is closely linked to the use of natural resource potential and, consequently, is accompanied by environmental pollution. Irrational use of natural resources has a significant impact on ecosystems, and sometimes it leads to the fact that some areas and even regions become a zone of ecological or natural disaster.Since agricultural production plays a dominant role in solving the food problem of the state, its main task is not only to preserve the potential of fertile lands, but also the rational use of all natural resources in this area, especially land, water, minerals, climate, biological , as well as solar energy [4].

Scientists point to four main causes of soil degradation. The first - erosion, mechanical destruction of soils by water and wind.

The second - desertification, aridization - more and more soils become unsuitable for agriculture due to drying. Third - toxicity, contamination of soils with various anthropogenic substances, including due to improper irrigation.Fourth - direct losses due to the allocation of agricultural land for urban buildings, roads, airfields, etc. In these conditions, the central place is occupied by the problem of land protection, which in a relatively short time went beyond the direct protection of land and became important for the preservation of land as a major component of the biosphere [6].

One of the most painful problems of agricultural ecology is excessive chemicalization. Currently, agriculture is increasingly using chemicals to kill pests, pesticides. Excessive use of mineral fertilizers, in particular nitrogen, leads to an increase in the content of nitrates in food, which is dangerous to human health.Reducing livestock in livestock production leads to a decrease in the use of organic fertilizers and increases the use of mineral fertilizers [5].

Modern agricultural technologies for maximum effect must be adapted to soil and climatic conditions. We have identified priorities that can be the basis of modern farming systems: optimization of the content of organic matter in the soil, mobile forms of nutrients; achieving a deficit-free balance of humus and nutrients in the soil; protection of soils from erosion; reclamation of acid and solonetzic soils;elimination of moisture deficiency; protection of soils from pollution, overcompaction, overwetting; elimination of moisture deficiency.

The costs of implementing the main measures for soil protection are about 41-48 billion UAH / year, in particular at the expense of state, local budgets and land users [6].

An important aspect is the use of international experience in environmental protection of land use. The world has accumulated many examples of progressive land use that deserve to be studied and used as much as possible.International activities need to be intensified in order to develop an effective strategy to protect soils from degradation. Today in the world, in particular in Europe, a modern soil protection policy is being formed, which is based on the following principles: independence from land ownership; soil monitoring on uniform principles; zoning of the territory with the allocation of soils "hot spots",with unfavorable properties.

The source of information about soils is monitoring. The main features of European soil monitoring: independence from departmental influence; accessibility of the population to information on the condition of soils.

When toxic substances get into this environment, they can stay in it for a long time with the initial danger, pass into plants, then animals and food into the human body. Therefore, the system of monitoring the condition of the soil cover due to anthropogenic impact is an important component of environmental monitoring.

One of the most toxic soil contaminants is heavy metals. They can get into the soil with mineral fertilizers, limestone materials, pesticides, exhaust gases of vehicles, with emissions from industrial enterprises.

Natural soil pollution is the result of heavy metals and their various forms from parent rocks and deep ore deposits. Under conditions of intense anthropogenic impact, the inflow of heavy metals into the agroecosystem exceeds its protective properties. This reduces the yield and quality of crop products, making it dangerous for humans and animals.

Today, heavy metals occupy one of the first places among man-made pollutants. Large industrialized agglomerations are powerful sources of pollution of all components of the environment.A great danger in the modern ecosystem is soil contamination with such elements as lead, zinc, copper and cadmium. Their adverse effects lead to an increase in mortality, morbidity, so the research topic is relevant [2].

In agriculture, intensive use of fertilizers, especially mineral and chemical ameliorants, causes changes in the quantitative composition of heavy metals. These elements are in natural fertilizers natural impurity, their size depends on initial raw materials (agroruds) and technologies of its processing.Heavy metals are well absorbed by soils, form sparingly soluble compounds with phosphates and hydroxides, which contributes to their gradual accumulation in the soil environment. This leads to an increase in the toxic potential of the soil, affects its biological activity, causes pathological changes in the course of biological processes, the accumulation of harmful substances in crops.The accumulation of heavy metals in the soil affects its fertility and microbiological activity. Heavy metal pollution is one of the factors that determine crop productivity and agricultural product quality. Toxicity of heavy metals to plants is determined not by their gross content in the soil, but mainly by the content of their mobile compounds.

Therefore, the research we conducted on land resources in the Khmilnytskyi district is important for further research.

The ecological situation on the territory of Khmilnytskyi district remained relatively stable.

Volumes of emissions from stationary sources into the atmosphere according to statistics for Khmilnytskyidistrict, taking into account emissions from Khmilnyk for the last period were small: they accounted for about 3.5% of the total regional (5.4 thousand tons; of which emissions from Khmilnyk - 5.1 thousand tons).Emission density per 1 km of the territory of the district averages 4.3 tons (in the city of Khmilnyk - 245 tons), per 1 person - 86.3 kg. Indicators in the district as a whole are much lower than the regional averages (5.9 tons and 98.4 kg, respectively).

The study of the agroecological condition of agricultural soils was carried out on such indicators as the concentration of lead, cadmium, zinc and copper, manganese, cobalt in the soil.

Selection of soils to study their intensity of heavy metal contamination was performed by the envelope method.

To determine the content of mobile forms of nitrogen, phosphorus, potassium, calcium, magnesium accepted sampling standards.

Depending on the purpose of the study, the size of the test site, the number and type of sample should correspond to those listed in table 1.

Table 1

Requirements for soil sampling

The purpose of research	The size of the test site		Number of samples
	homogeneous soil covering	inhomogeneous soil covering	
The content of chemicals in the soil	From 1 to 5 hectares	From 0.5 to 1 hectare	At least one pooled sample
Definition of physical properties and structure of the soil	From 1 to 5 hectares	From 0.5 to 1 hectare	From 3 to 5 spot samples on one soil horizon

The weight of the pooled sample should be about 1 kg. Samples taken for chemical analysis should be packaged, transported and stored in chemically neutral containers.

Agroecological passport of a field or land plot is a document that certifies the state of soil fertility and its dynamics.

The main indicators that determine the fertility of field soils are: the content in the arable layer of humus, nitrogen (easily hydrolyzed), mobile phosphorus, metabolic potassium and trace elements (manganese, zinc, copper, boron), as well as soil acidity (pH), the amount of absorbed bases, soil density, the maximum possible reserves of productive moisture in the layer 0-100cm.

In order to establish agrochemical parameters of the soil, we analyzed the results of selected soil samples in the studied areas (Table 2).

Table 2

Ecological and agrochemical indicators of soil

Agrochemical indicators	Units of measurement	Scientific research of test methods	Content in the soil	Actual value
Acidity pH(salt)		DSTU ISO 10390-2007	neutral	6,5
Humus	%	GOST 26213-91	high	4,98
Nitrogen is hydrolyzed (by Cornfield)	mg / kg	DSTU 7863-2015	low	133
Mobile phosphorus,P_2O_5 (according to Chirikov)	mg / kg	DSTU 4115-2002	very high	404
Potassium exchange,K_2O (according to Chirikov)	mg / kg	DSTU 4115-2002	very high	710
Exchangecalcium	mg-eq / 100 g of soil	GOST 26487-85	increased	14,10

Thus, highly degraded chernozems of medium loam, which predominate in Khmilnytskyi district, are characterized by neutral acidity, humus content is high, so these soils are enriched with plenty of organic matter, which is positive for their use in rural agriculture.

The content of mobile phosphorus and exchangeable potassium is characterized by very high indicators, which may mean that mineral fertilizers applied in the village are mostly high in terms of phosphorus and potassium. The content of hydrolyzed nitrogen is low, so it is recommended to apply nitrogen fertilizers or sow perennial legumes, which will enrich the soil with nitrogen.

In addition to macronutrients (N, P, K, Ca, Mg, S), 14 more elements are important in plant nutrition for growing high and sustainable crop yields. The most important are the six elements - B, Mn, Cu, Zn, Co, Mo.Due to the fact that their content in soils is quite small (0.01 - 0.001% on dry matter), they are called trace elements, and fertilizers that contain them - microfertilizers. Most micronutrients are required for normal plant growth and development because they perform important physiological functions. Thus, trace elements are part of enzymes, vitamins, hormones and other biologically active substances and play an important role in the synthesis of proteins, carbohydrates, fats and vitamins.With the optimal provision of plants with trace elements, their development and maturation of seeds is accelerated, resistance to diseases and pests is increased, the effect of external adverse factors - drought, low and high temperatures of air and soil is weakened.In addition, they protect plants from bacterial and fungal diseases (flax bacteriosis, cork spot of apples, rotten beet hearts, gray spot and graininess of cereals, rosette of fruit, various chlorosis diseases), but unlike pesticides, this is due to increased plants.Throughout the growing season, plants feel the need for essential trace elements. Trace elements cannot be replaced by other substances, and their deficiency must be compensated. Only then can you get quality products that meet the optimal content for a particular type of sugars, amino acids, vitamins [5].

Plants can use microelements only in water-soluble form (mobile forms of microelement), their immobile forms become suitable after the course of complex biochemical processes with the participation of soil humic acids. In most cases, these processes are very slow, under irrigation, a significant part of the mobile forms of trace elements can be washed away.

Most trace elements are active catalysts that accelerate a number of biochemical reactions. The combined action of trace elements significantly enhances their catalytic action. Often only their combination can ensure the normal development of

plants. Trace elements also affect the formation of biocolloids and the direction of biochemical processes.Thus, manganese regulates the ratio of divalent and trivalent iron in cells. The ratio of iron: manganese should be more than 2. Copper protects against the destruction of chlorophyll and allows you to increase the rate of nitrogen and phosphorus almost twice. Boron and manganese intensify the process of photosynthesis after freezing plants. An unfavorable ratio of nitrogen, phosphorus and potassium can cause diseases of plants treated with microfertilizers.

Compared with macronutrients, the content of micronutrients in soils is low. Thus, the average content of mobile boron in the soils of Ukraine varies between 0.1-2.0 mg / kg, molybdenum - 0.03-0.60, zinc 0.2-2.0, manganese - 25-190 mg / kg. Therefore, not all soils can fully meet the needs of plants for trace elements.

The main reason for the deficiency of micronutrients is primarily their poor availability to plants. According to agrochemical studies, most soils in Polissya are well supplied with manganese and satisfactory copper, but they contain little boron, molybdenum, zinc.Forest-steppe soils are rich in manganese, sufficiently supplied with copper, satisfactory molybdenum, weak boron and zinc. In soils with a high content of humus and heavy particle size distribution, the content of trace elements is high. But here there is a lack of them in a form accessible to plants.

It is established that microelements in the form of inorganic salts show efficiency only on acid soils. In soils with a reaction close to neutral, their effectiveness is reduced tenfold. In neutral and slightly alkaline soils, inorganic salts can not contain trace elements in water-soluble, in a form accessible to plants, and their effectiveness is close to zero.This is due to their transition to sparingly soluble forms (hydroxides, carbonates) and a sharp cessation of availability for assimilation by plants.

For plants, the use of trace elements is more effective in the form of metal complexates (chelates), which have a number of advantages. Thus, chelates are stable on all types of soils, regardless of their acidity level.

Manure is an essential source of micronutrient removal. However, only at the rate of 13.5 tons of manure per 1 hectare of crop rotation area under the organo-mineral fertilizer system, their removal by crops, except for manganese and boron, is almost compensated.

Table 3

Grouping of soils by the content of mobile forms of microelements

№ group	The content of the element	mg per 1 kg of soil			
		Boron	Manganese	Copper	Zinc
I	Very low	<0,15	<15	<0,70	<0,30
II	Low	0,15-0,22	15,0-20,0	0,70-1,00	0,30-0,50
III	Average	0,23-0,33	20,1 -30,0	1,01-1,50	0,51 -0,70
IV	Increased	0,34-0,50	30,1 -45,0	1,51 -2,20	0,71-1,00
V	High	0,51-0,70	45,1-70,0	2,21 -3,30	1,01-1,50
VI	Very high	>0,7	>70	>3,30	>1,50

According to soil studies on the content of mobile forms of trace elements (Table 3), we can conclude that the content of boron and manganese is within normal limits. The sulfur content is low and the iron content is very low. Magnesium content is also increased.

Table 4

The content of mobile forms of trace elements in soils v. Maryanivka

Moving form of the microelement	Units of measurement	Scientific research of test methods	Content in the soil	Actual value
Mobile boron	mg / kg	GOST 10 156-88	very high	2,86
Mobile manganese	mg / kg	DSTU 4770.1-0017	very high	21,36
Mobile sulfur	mg / kg	DSTU 8147-2015	GOST 10 156-88	5,3
Mobile magnesium	mg-eq / 100g of soil	GOST 26487-85	increased	2,42
Mobile iron	mg / kg	DSTU 4770.1-0017	verylow	1,56

Trace elements in the soil play an important role in plant nutrition. As iron and sulfur content are low, sulfur and iron-containing micro fertilizers can be used as a recommendation.

The ecological condition of the field is determined by the level of contamination by radionuclides (Cs137, Sr90), heavy metals (cadmium (Cd), lead (Pb), copper (Cu), zinc (Zn)). reclamation, to establish systematic work to increase soil fertility.

Table 5

The intensity of heavy soil pollutionmetals, mg / kg

Heavy metals	Actual content	Maximum permissible concentration	Hazard factor
Lead	0,74	6,0	0,12
Cadmium	0,13	0,7	0,18
Zinc	1,07	23	0,04
Copper	0,60	3,0	0,2

Analyzing soil contamination with lead, cadmium, zinc and copper, we note that their content was lower than the MPC by 8.1 times, 5.38, 21.4 and 5.0 times, respectively. The highest content of heavy metals in the soil was observed for zinc, compared to lead, cadmium and copper, it was 1.44, 8.23 and 1.78 times higher, respectively.

The hazard factor of heavy metals (Fig. 1) was the highest for copper.

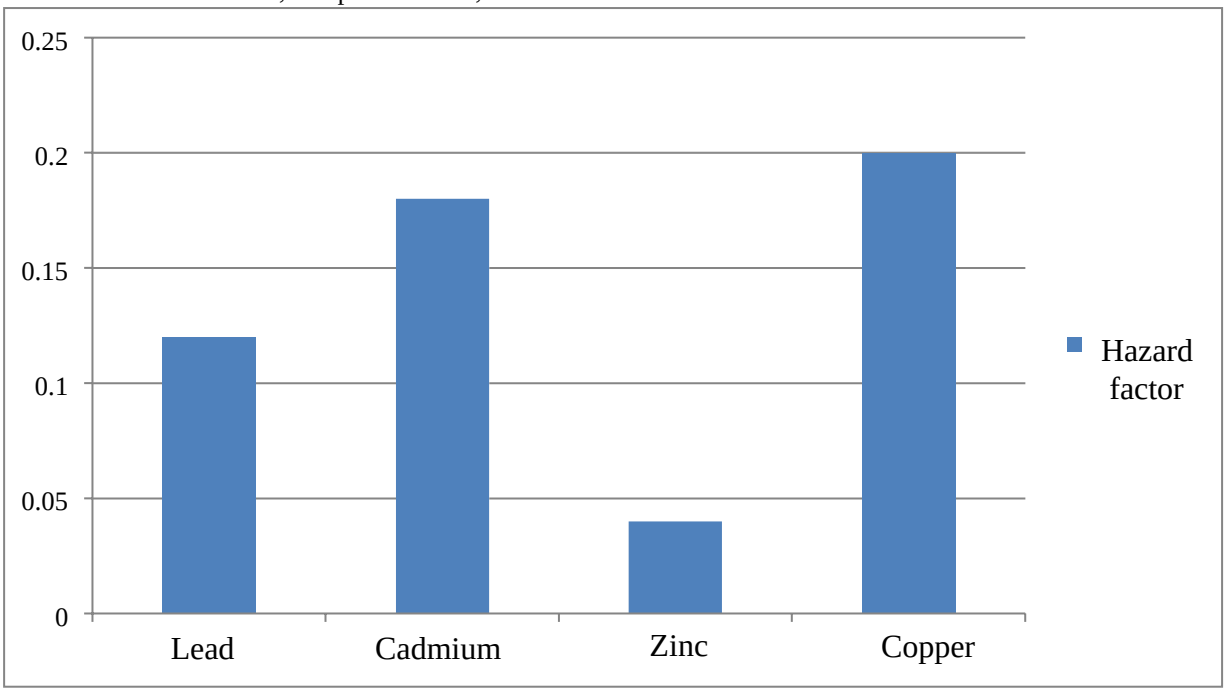

Fig. 1. Hazard ratio of heavy metals

Compared to lead, cadmium and zinc, it was 1.66, 1.11 and 5.0 times higher, respectively.

The strategy of improving the condition of soils and increasing their fertility includes:

Use of a ploughless tillage system. It is necessary to pass to the minimum cultivation. With traditional methods, we lose moisture, and hence the harvest. Minimal treatment helps retain moisture.

Planning crop rotations for 5-7 years ahead with the mandatory inclusion of 30% of legumes. Planning crop rotations for such a long period can be a difficult task, because there are certain market needs that farmers want to track and take into account. However, you need to learn to work with long-term planning to get a good harvest.

Application of manure compost. Now livestock farming has significantly decreased, so there are problems with the application of sufficient amounts of organic fertilizers. However, the application of compost must be made a mandatory stage of agricultural production. The technology of composting does not matter much.

Work with plant remains. This is useful not only for the soil, but also for agricultural production itself. Destructors should be used to peel the stubble, and nitrogen-fixing bacteria should also be used.

The use of greens and perennial herbs. Without greening on some soils today it is impossible to get a good harvest. Green manure should be used at least once every 5 years.

The use of biological products for plant protection. Biologics are a good tool for growing crops. Biologicals are being developed very intensively in Europe today, new strains of bacteria and new approaches are being sought. In 10 years, they can provide organics with a good tool for growing crops. There are similar factories in Ukraine, but they need more time, because so far they are building capacity. In general, now large chemical companies are actively engaged in biological protection.

Work with soils in a complex, the account of all layers of soil when carrying out agrotechnical actions. Mykola Bykov advises to work with all layers of soil: not only surface 5 cm, but also a layer of 15 cm, which will accumulate capillary moisture, and a layer of 40 cm, which must absorb moisture from the surface layers.

The problem of burning crop residues (straw), which still exists in Ukrainian fields, should be mentioned separately. It's actually burning money. This is the loss of nitrogen, which could enrich the soil - 1 ton of straw contains up to 80 kg of nitrogen. In addition, combustion stops the processes in the soil, 2-3 cm destroys the entire biota. This is a significant loss that can be avoided by stopping the burning of crop residues.

To address the problem of restoring soil fertility in order to achieve their neutral level of degradation, Ukraine must have a clear strategy for soil protection, prevention and control of land degradation, which includes the effective functioning of soil protection programs and laws, strict control over their implementation, monitoring, mandatory rationing of anthropogenic loads, responsibility of the government and all land users, compliance with the recommended and introduction of the latest soil protection technologies.

To increase soil fertility and achieve a neutral level of degradation, it is necessary to: develop proposals for draft laws and regulations on soil monitoring; prepare a Concept and recommendations for ensuring a neutral level of soil degradation; to create a soil information center; to revive stationary experiments on the study of soil processes and regimes, directions of soil evolution under the predicted climate change; to adapt agricultural technologies. The implementation of the National Action Plan to Combat Soil Degradation, which includes a list of relevant measures for the period up to 2030, will help address this issue.

The system of ecological and economic use of lands must have an environmental, resource-saving character and provide for the preservation of soils. Land protection and their rational ecological and economic use should be carried out on the basis of an integrated approach to land use as complex natural formations (ecosystems), taking into account their zonal and regional characteristics. One of the areas of rational use of agricultural land is the intensification of the use of modern innovative technologies for growing crops. This area of improvement is capital-intensive but effective, including from an environmental point of view.

Currently, an inventory, cadastral assessment of land, a state system for managing the quality of land resources and its place in public administration and the principles of delimitation of responsibilities of the state, landowners and land users for the protection of land resources. The main role in ecological balancing and reproduction of land resources belongs to the state.

Highly degraded medium-loam chernozems, which predominate in the Khmilnytskyi district, are characterized by neutral acidity, humus content is high, so these soils are enriched with plenty of organic matter, which is positive for their use in agriculture.

According to soil studies on the content of mobile forms of trace elements, it can be concluded that the content of boron and manganese is within normal limits. The sulfur content is low and the iron content is very low. Magnesium content is also increased.

Analyzing soil contamination with lead, cadmium, zinc and copper, we note that their content was lower than the MPC by 8.1 times, 5.38, 21.4 and 5.0 times, respectively. The highest content of heavy metals in the soil was observed for zinc, compared to lead, cadmium and copper, it was 1.44, 8.23 and 1.78 times higher, respectively. The hazard ratio of heavy metals was the highest for copper.

Introduction of integrated agriculture, based on a combination of positive aspects of alternative and intensive farming systems;it is necessary to optimize the structure of land and sown areas, to introduce soil protection technologies for growing crops, to strengthen state control over land use, to provide funding for land protection and soil protection measures;to introduce ecological education of the population, to hold seminars, trainings with heads of agricultural enterprises, to develop ecological movement in Ukraine by creation of various ecological organizations and reduce the use of mineral fertilizers, instead increase the use of organic fertilizers.

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ОРГАНИЗАЦИЯ АВТОМАТИЗИРОВАННОГО МОНИТОРИНГА ДЛЯ РАСЧЕТА РЕЧНОГО СТОКА С ВОДОСБОРНОЙ ТЕРРИТОРИИ Р.ОКА

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ORGANIZATION OF AUTOMATED MONITORING FOR CALCULATION OF THE RIVER RUNOFF FROM THE DRAINAGE TERRITORY OF THE R.OKA

Аннотация.
Организация системы мониторинга речного стока упирается в финансовые возможности организаций и бюджет местных администраций. Предложенный в статье метод мониторирования стока может стать заменой традиционным методам, за счёт автоматизированных расчётов и практически моментального предоставления данных пользователю.

Abstract.
The organization of a river flow monitoring system rests on the financial capabilities of organizations and the budget of local administrations. The flow monitoring method proposed in the article can replace traditional methods, due to automated calculations and almost instantaneous provision of data to the user.

Ключевые слова*: речной сток, водосборная территория, метеостанция, датчики, мониторинг.*
Keywords*: river runoff, catchment area, meteorological station, sensors, monitoring.*

Речной сток реки Ока в основном не зарегулирован, вследствие этого в период паводков или половодий повышается риск возникновения гидродинамической аварии на плотине Чебоксарского водохранилища.

Стоимость зарегулирования, такой большой реки не сопоставима со стоимостью организации автоматизированного мониторинга на всей ее водосборной территории. Исходя из стоимости, можно рассмотреть 3 варианта организации мониторинга:

1) бюджетный или самый дешевый;

2) стандартный, средней стоимости;

3) дорогостоящий, с возможностью точного прогноза и решением многоцелевых задач.

Разберем каждый из них подробнее.

1) Бюджетный. Самым бюджетным вариантом в данном случае была бы установка на всех имеющихся гидрологических постах специализированных датчиков по снятию показателей уровня и расходов воды в режиме реального времени. Основными плюсами бюджетной организации мониторинга помимо дешевизны, можно выделить:

- получение данных фактического речного стока в режиме реального времени;
- возможность составления примитивных прогнозов.

Организация мониторинга даже по такому пути значительно облегчило бы работу гидрологам бассейна реки Оки и Чебоксарского водохранилища на Волге.

2) Стандартный. Не значительно дороже, чем первый вариант, однако эффективность его будет существенно выше. Помимо ранее озвученных датчиков, будет также включать в себя размещение относительно не дорогих модульных метеостанций (1 метеостанция на 400 км^2, что в сумме составит примерно 613 единиц). Сеть модульных метеостанций позволило бы дополнить картину по климатическим параметрам на всей водосборной территории. Точное наблюдение за температурой воздуха, количеством выпавших осадков и направлением ветра, позволит примерно рассчитать поверхностный сток, а это в свою очередь даст более точный прогноз по изменению уровня и расходов воды в реке Ока.

В качестве модульной метеостанции можно было бы рассмотреть вариант, разработанный Центральной Аэрологической Обсерваторией совместно с Научно-Исследовательским Институтом в Сколково. Данная метеостанция прошла комплексные испытания, легко переносится, может передавать данные как через сеть интернет, так и записывать на переносные устройства. Фиксирует следующие данные:

- температура атмосферного воздуха;
- наличие атмосферных осадков и их количество;
- скорость и направление ветра;
- влажность воздуха.

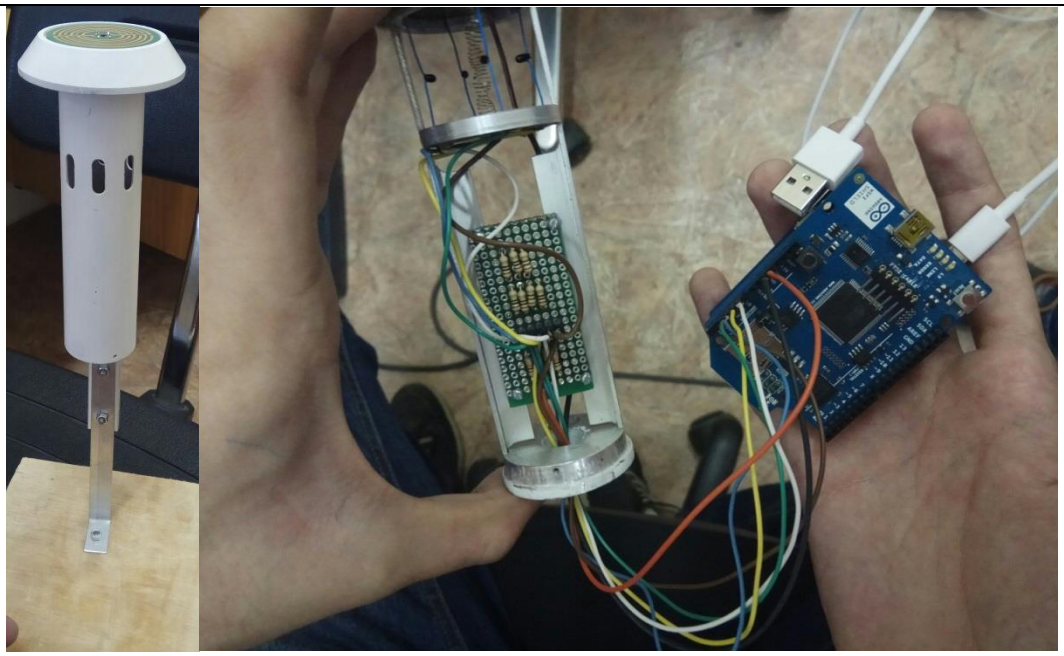

Рисунок 1 – Корпус и часть электроники модульной метеостанции

По данным модульных метеостанций, можно построить максимально точные климатические карты по всей водосборной территории. Благодаря им мы бы смогли рассчитать объемы поверхностного стока с учетом испарения.

3) Дорогостоящий. Самый дорогой вариант организации автоматизированного мониторинга на водосборной территории.

Для расчета данных по речному стоку, необходимы актуальные данные показателей климатических характеристик, расходов воды и характеристик почв.

Важный критерий для расчета объемов воды, поступающих в водотоки, является структура и влажность почвы. Растения, как правило, задерживают влагу для собственного питания, и если почва сухая, то часть атмосферных осадков потребуется для увлажнения почвы и удовлетворения потребности растениям. Исходя из этого, логичным вариантом было бы разместить датчики влажности почв.

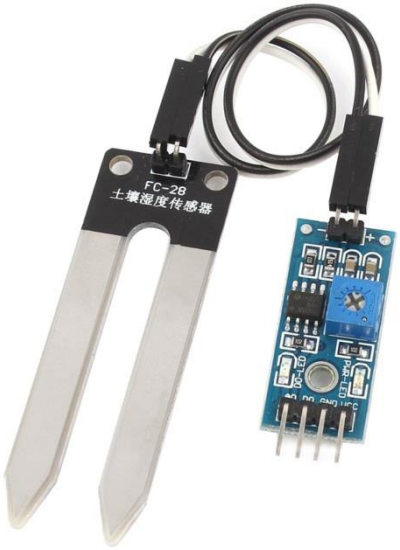

Рисунок 2 – Датчик влажности почвы

В качестве контрольных точек, датчики можно установить совместно с модульными метеостанциями в том же количестве: 613 единиц на всю территорию, однако в идеальном случае не лишним было бы их установить и на сельскохозяйственных участках.

Система мониторинга бассейна реки Оки должна включать в себя:

- базу данных;
- датчики и оборудование для непрерывного снятия данных;
- расчетная программа непрерывного действия.

Базу данных можно организовать в электронных документах форматов «.csv» или «.xlsx». В нее должны войти данные рельефа местности, данные

многолетних наблюдений за речным стоком и вспомогательные данные характерные для расчетов исследуемой территории.

Датчики и оборудование, в виде приборов для снятия показания по изменению уровня и расходов воды, модульных метеостанций и датчиков влажности почв, должны непрерывно передавать свои измерения в базу данных. Для совместимости с базой форматов «.csv» или «.xlsx», датчики должны быть «прошиты» соответственно.

Расчетная программа в данном случае, будет замыкать цикл. Проводя полную аналитику обновляемых показателей из базы данных, она должна формировать отчет в виде текущей ситуации с составлением прогноза по речному стоку. Отчетные документы будут размещаться либо в базе данных, либо в виде отдельного документа по желанию пользователей.

Не маловажную роль в эффективности мониторинга занимает расположение контрольных точек для сбора данных.

Метеорологические наблюдения. Как говорилось ранее для бассейна реки Ока, достаточно одной модульной метеостанции на 400 км^2. Площадь водосборной территории составляет 245 000 км^2, то есть потребуется примерно 613 единиц приборов.

На рисунке 3 приведена примерная схема установки модульных метеостанций, где красные кружки – это приборы, зеленый сектор составляет 400 км^2, а голубой – зона пересечения наблюдений 2-станций. Схема расположения именно таким способом рассматривается с целью экономии средств, и минимальными потерями в эффективности. Выполнив простое математическое решение, мы можем точно определить необходимое число приборов для всей водосборной территории.

Рассмотрим один квадрат, зеленая площадь в нем составит 100 км^2, по другому это можно выразить как площадь квадрата минус площадь сектора круга с углом в 90^0.

$$r^2 - \frac{r^2 П}{4} = 100 \text{ км}^2$$
$$r^2(4 - П) = 400 \text{ км}^2$$
$$r^2 \approx \frac{400}{0{,}858} \text{км}^2$$
$$r^2 \approx 21{,}6 \text{ км}$$

Значит, расстояния между модульными станциями составят:

$l_1 = 21{,}6\sqrt{2} = 30{,}5$ км; и $l_2 = 21{,}6 \cdot 2 = 43{,}2$ км.

Теперь можно определить площадь пересечения наблюдений 2-х станций.

$$F = 2 \cdot \left(\frac{21{,}6^2 \cdot П}{4} - \frac{21{,}6^2}{2}\right) = \frac{21{,}6^2 \cdot П}{2} - \frac{2 \cdot 21{,}6^2}{2}$$
$$= \frac{21{,}6^2(П - 2)}{2} \approx 266 \text{ км}^2.$$

По рисунку видно, что каждые 2 станции имеют одно общее пересечение, 3 станции имеют 2 общих пересечения и так далее. Исходя из этого, можно найти необходимое количество метеостанций для всей водосборной территории. Для этого мы составим уравнение. За n возьмем число оборудований на 400 км^2, значит количество пересечений меду станциями площадью 266 км^2 будет n-1. Отсюда получается уравнение.

$$400n + 266(n - 1) = 245\,000 \text{ км}^2,$$
$$666n = 244\,734 \text{ км}^2,$$
$$n \approx 368 \text{ единиц.}$$

Значит, для покрытия всей территории бассейна реки Оки и ведения эффективного мониторинга за климатическими характеристиками потребуется 368 единиц модульных станций.

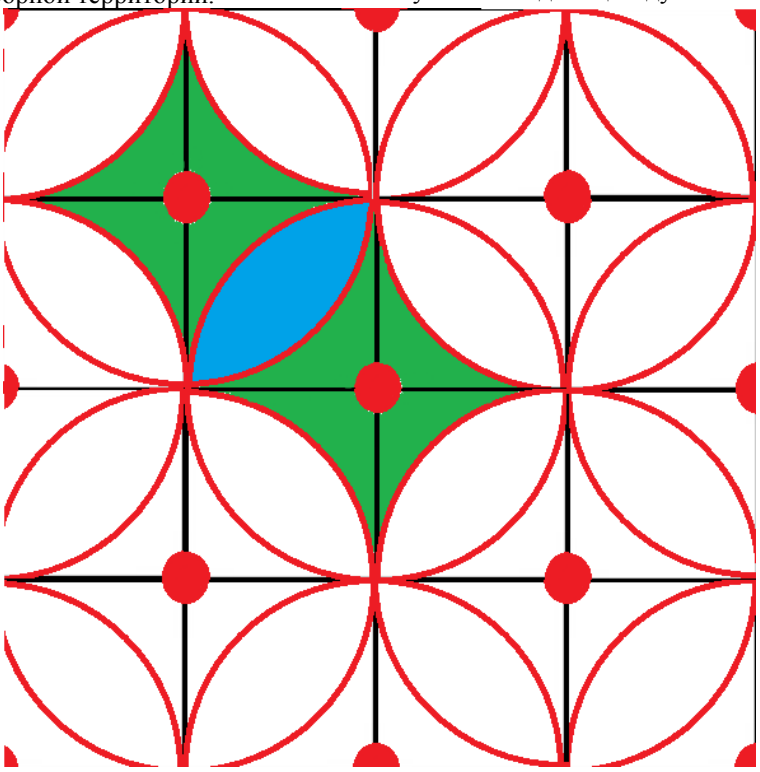

Рисунок 3 – Схема расположения модульных метеостанций

Наблюдения за влажностью почвы. Чтобы иметь представления о степени увлажненности водосборной территории реки Оки, достаточно разместить датчики влажности почв рядом с модульными метеостанциями. Однако, так как прогресс не стоит на месте, и фермерские хозяйства все больше стремятся к созданию автоматизированных систем для мониторинга полива и всходов сельскохозяйственных культур, можно было бы на условиях взаимной выгоды разместить датчики влажности и там. Это существенно бы повлияло не только на мониторинг за бассейном реки Оки, но и значительно повысило бы урожайность в фермерских хозяйствах.

Гидрологические наблюдения. Гидрологические посты должны располагаться на ключевых отрезках реки:

- непосредственной близости к крупным населенным пунктам;
- выше и ниже по течению относительно соединений с притоками реки Оки.

Для расчета расходов воды на постах необходимо установить автоматизированные датчики за уровнем воды и скоростью течения. Статичные характеристики типа формы русла, должны быть занесены в базу данных, чтобы расчетные программы, исходя из показателей, высчитывали средний расход воды.

При этом автоматизированный гидрометрический створ, не должен негативно влиять на прохождение водного транспорта. Для решения этой проблемы можно предложить следующий вариант (Рисунок 4).

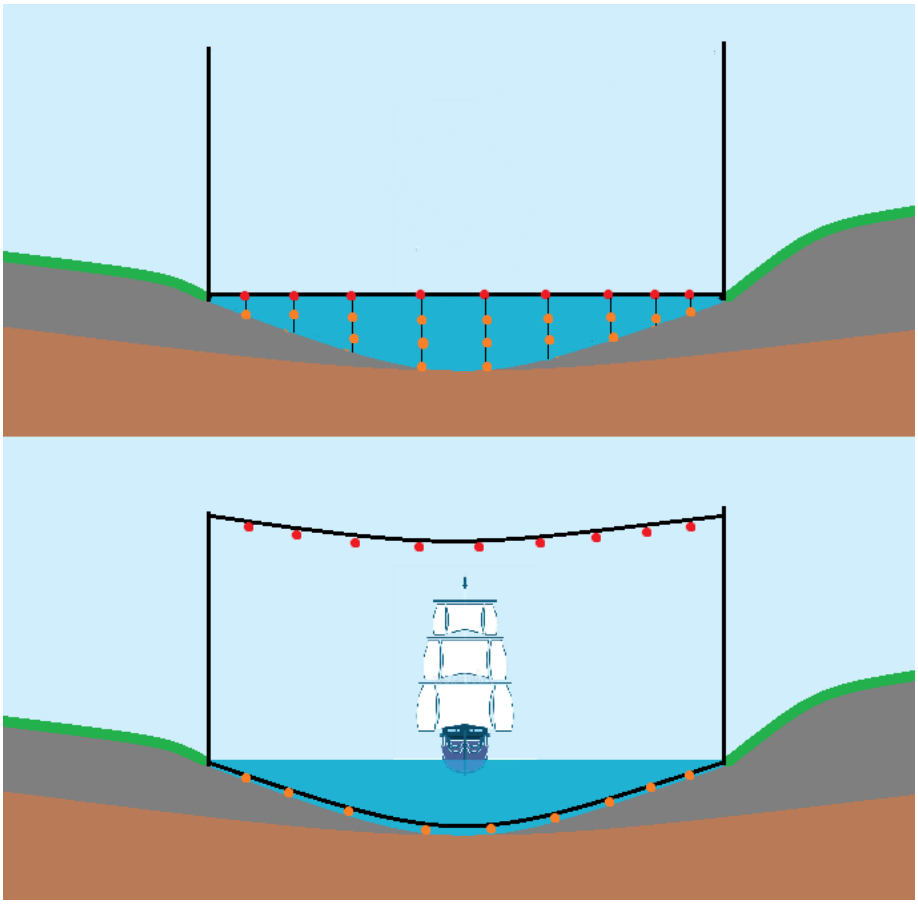

Рисунок 4 – Схема оборудования гидрометрического поста наблюдения

На рисунке показано красным – датчики уровня воды, оранжевым – датчики скорости течения. При приближении транспорта, трос с датчиками уровне воды поднимается при помощи специальной лебедки по шарниру, в тоже время датчики скорости течения погружаются на дно, в это время питание датчиков отключается, и они временно не работают. Высота балок, по которым будет подниматься трос не должна быть высокой, так как по реке Оке проходят суда с мелкой осанкой. Что же качается обычных лодок, то они смогут передвигаться беспрепятственно, так как датчики уровня воды представляют собой поплавки, а трос, удерживающий их, необходим только для поднятия на определенную высоту.

Работа датчиков и расчетных программ, будет идентична методу «скорость-площадь». Подробнее о принципе работы систему можно узнать в публикациях[1,2].

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BREEDING A NEW POPULATION OF MEAT-BASED SIMMENTAL CATTLE IN THE CARPATHIAN REGION OF UKRAINE

Abstract.

It has been found that the growth rate in this type of repair heifers from birth to 7 months of age in the genotype Simmental Canadian$^{3}/_{4}$ + Simmental Austrian$^{1}/_{16}$ Simmental German$^{1}/_{8}$ + Simmental American$^{1}/_{16}$ is higher; they reliably predominate by 3.4% (P<0.001) their improved peers of the genotype Simmental Combined$^{1}/_{32}$ Simmental Canadian$^{27}/_{32}$ Simmental Austrian$^{1}/_{32}$ Simmental German$^{3}/_{32}$ in the herd of the State Research Farm «Chernivetske». It has been determined that a correlation in repair heifers with the final genotype Simmental Canadian$^{3}/_{4}$ Simmental Austrian$^{1}/_{16}$ + Simmental German$^{1}/_{8}$ + Simmental American$^{1}/_{16}$ between the live weight during the period of rearing was low and negative: at birth r=-0.13 (P>0.095); at 7 months of age r=-0.02 and at 12 months of age r=-0.05 (P>0.095). The studies have determined that the linear and mass dimensions of a new population Simmental cattle increase with the raise of their heredity in the genotype Simmental Canadian$^{3}/_{4}$ Simmental Austrian$^{1}/_{16}$ + Simmental German$^{1}/_{8}$ + Simmental American$^{1}/_{16}$. Their live weight increased by 15.5 kg, the height at withers – by 3.1 cm, the chest circumference – by 4.8 cm, the oblique length of the torso and buttocks – by 1.7 and 2.1, respectively, and the overall dimensions – by 13.5 cm.

It has been found that the growth rate in the repair heifers of meat-based polled Simmental cattle from birth to 7 months of age in a new productive genotype Simmental Canadian$^{3}/_{4}$ Simmental Austrian$^{1}/_{16}$ + Simmental German$^{1}/_{8}$ + Simmental American$^{1}/_{16}$ is 15.7%; they reliably predominate by 3.4% (P<0.001) their improved peers of the genotype Simmental Canadian$^{25}/_{32}$ + Simmental Austrian$^{1}/_{16}$ + Simmental German$^{1}/_{8}$ + Simmental American$^{1}/_{32}$ in the State Research Farm «Chernivetske».

Keywords: *bulls, tufts, diet, complex preparation, live weight, daily increments*

Setting the problem. In order to provide the population of the country with livestock products, the State Program in the direction of rearing specialized breeds of cattle with high genetic potential of meat productivity was implemented in different regions of Ukraine. In the Western region of Ukraine, in particular in Bukovyna and Halychyna, it has been bred a new population of Bukovyna zonal type meat-based Simmental cattle with productive herds of animals having satisfactory reproductive abilities, the genetic potential of milk and meat productivity, as well as the growth energy in all physiological periods of growing, which is the most relevant for the region [1, 2].

Analysis of recent research and publications. The breeding program for qualitative transformation of local Bukovyna type Simmental breed of the combined direction of productivity using domestic and foreign gene pool of meat-based Simmentals of various breeding and lines in basic and subsidiary farms of Chernivtsi region during 1999-2019 with the formation of new type Bukovyna zonal meat-based Simmental cattle for the Ukrainian Carpathians was developed [3].

The reliable assessment of beef cows in terms of milk productivity is of great importance in the breeding production practice of foreign countries. Based on the generalization of foreign experience using a linear assessment of beef cattle exterior, domestic breeders conduct research on breeding, consolidation and improvement of the new Ukrainian Simmental cattle, which are reared in different regions of Ukraine. When forming the highly productive meat herds, the animal is evaluated by 15 characterstics. The assessment of the first calving cows is carried out during the first lactation in the accepted points according to the instructions [4, 5].

Thus, the efforts of breeders are aimed at assessing the population of mother-stock by phenotype, udder structure, mammary glands and limb strength. The breeding should take into account not only the type and importance of productivity, but also growth, temperament, reproductive abilities and other characteristics. For further cattle breeding, it is necessary to leave for rearing the posterity from the best meat cows-mothers to repair their own herd and sell the breeding young ones to other farms in the regions of Ukraine.

A long-term breeding work allows forming the cattle with high genetic potential of milk and meat productivity provided sufficient feeding during the year (not less than 65 quintals of feed units per beef cow with progeny) according to the norms of feeding beef cattle in the Carpathian region.

In the future, it is necessary to consolidate the achieved genetic potential of productivity, improve the

reproductive functions of animals and provide the appropriate housing conditions that promote good health and prolonged productive use of cows for different climatic zones of the Carpathians [6-14].

Setting the objective. The aim of the research is to breed a new population of meat-based Simmental cattle, in the direction of increasing the genetic meat potential of productivity for cheap beef in the Carpathian region of Ukraine.

In order to obtain the above results, many years of the following breeding work has been carried out:

– breeding the high-value sires evaluated for the quality of posterity;

– the phenotypic assessment of first calving cows;

– the measurement of main physical characteristics of first calving cows;

– the comprehensive assessment of cows, young ones and sires;

– the formation of breeding groups and families, their renewal, breeding the animals for meat-based polled Simmental cattle;

– providing the system of growing meat-based polled repair heifers in accordance with the breed standard of weight and linear growth;

– breeding the repair bull-calves for insemination of mother-stock of Simmental and meat-based Simmental cattle in the area of their breeding;

– the formation of herds of mother-stock of meat-based polled Simmental cattle;

– the determination of the live weight in new genotypes of meat-based Simmental cattle;

– the formation of the herd by age and live weight of animals;

– the determination of average daily gains in all age periods of breeding;

– the determination of the fertility index in the cows of meat-based polled Simmental breed;

– the determination of the insemination rate of mother-stock;

– the exterior assessment of first calving cows;

– the formation of the genealogical composition of cows by productive and reproductive abilities.

Material and methods of research. The herds of a new population of Bukovyna zonal type meat-based Simmental cattle with the use of cows and heifers of different new productive genotypes with different blood for breeding the future posterity in the Carpathian region of Ukraine served as material basis.

Thus, the data of statistical reporting, regulatory materials, the data of own research, literature sources, as well as the annual reports of zootechnicians-breeders in the studied basic and subsidiary breeding farms of the public sector of different forms of ownership in Bukovyna and Pokuttia were the main source for writing the article.

The breeding scientific work to create a population of meat-based Simmental cattle in the direction of increasing the genetic potential of productivity was carried out in the herds of farms of different forms of ownership in Chernivtsi and Ivano-Frankivsk regions with well-arranged zootechnical and breeding records.

The exterior was assessed roughly and by measuring the main body characteristics of the animals. The ones who did not meet the planned parameters were culled from the herd. Zootechnical (determination of live weight, measurements, body composition indices, as well as milk and meat productivity) and biometric (determination of average values, their errors and degree of probability) accepted methods were used.

The study was carried out in basic and subsidiary farms for breeding a new population of meat-based Simmental: the Ukrainian leading and operating State Research Farm «Chernivetske» (151 cows) and the following subsidiaries: Agricultural Production Private Co-operative «Peremoha» (85 cows) of Hertsaivskyi district, SOE «Rokytne», ALLC «Avangard» (65 cows) of Novoselytskyi district, Farm «Ivankivtsi» (45 cows), Agricultural Production Co-operative «Zoria» (30 cows) of Kitsmanskyi district, Chernivtsi region and Private Farm «Potochyshche» (95 cows) of Horodenkivskyi district, LLC «Toro» (45 cows) of Rohatyn district, LLC «Levada» (20 cows) of Kolomyia district, Farm «Zarichchia» (10 cows) and Private Farm «Bohdan» (45 cows) of Kosiv district, Ivano-Frankivsk region. The total number of livestock was 1339 heads, including 590 cows of a new generation in different parts of the Carpathians.

Presentation of the main material of the study. The characteristics of cows of a new generation of Ukrainian meat-based Simmental cattle, which are bred for many years in basic and subsidiary farms of different forms of ownership in Chernivtsi and Ivano-Frankivsk regions, are presented in Table 1.

Table 1

Characteristics of the presented cows in farms

Farm	Amount of cows, heads	Average age of the first calving, months	Live weight, kg	Average milk productivity by lactations, kg		
				lactations		
				first	second	third and older
Chernivtsi region						
Hertsaivskyi district						
State Research Farm «Chernivetske»	165	27	585	214	217	225
Novoselytskyi district						
SOE «Rokytne», ALLC «Avangard»	95	28.5	575	195	210	215
Agricultural Production Private Co-operative «Peremoha»	85	28	545	190	197	205
Private Farm «Kolosok-2»	14	27	565	215	220	227
Farm «Hai»	15	28.0	580	195	–	–
Kitsmanskyi district						
Agricultural Production Co-operative «Zoria»	30	28.1	575	190	215	220
Farm «Ivankivtsi»	45	29.5	565	195	220	225
Total:	444	27.5	561.7	202.5	208.7	217
Ivano-Frankivsk region						
Horodenkivskyi district						
Private Farm «Potochyshche»	85	28.0	563	190	205	211
Rohatyn district						
LLC «Toro»	50	27.5	556	191	197	201
Kosiv district						
Private Farm «Bohdan»	45	27.0	575	195	-	-
Farm «Zarichchia»	10	27.5	545	190	200	225
Total:	190	27.5	565	191	196	200
Total livestock:	634	27.5	563	196.5	202.3	209

It was found that the cows of the State Research Farm «Chernivetske» had the highest milk productivity of 225 kg in the third and older lactation, which was by 14 kg more than in the cows of the Private Farm «Potochyshche».

Analyzing the data (Table 2), it is seen that the daily gains in young animals of Bukovyna zonal type meat-based Simmental cattle in the summer suckling period are 830-950 g, while they are 770-855 g per day for the full cycle of growing.

It was found that the young cattle of meat-based Simmental breed of the State Research Farm «Chernivetske» had the largest daily gains of on average 877 g for a number of years, which was by 5.1-5.4% more than the cattle of other farms breeding that type of animal.

The zonal type of a new generation meat-based Simmental cattle is characterized by a high energy of growth and feed payment, a strong constitution, a rather high reproductive ability, an easy calving of cows and a multifertility of posterity. All these characteristics are also present in the newly created Bukovyna zonal type meat-based polled Simmental cattle, which makes it possible to breed these animals in the conditions of industrial technology (with leashed and grazed keeping in winter and on pastures in summer) without premature loss of health and fertility.

Table 2

Average daily gains of young cattle in the basic farms, g *(summer period)*

Farm	Status	Years								
		2009	2010	2011	2012	2013	2014	2015	2019	on average
Chernivtsi region										
Hertsaivskyi district										
State Research Farm «Chernivetske»	p/e	870	850	820	950	900	870	920	950	877
Private Cooperative «Peremoha»	s/e	750	700	650	750	780	800	800	850	738
Novoselytskyi district										
SOE «Rokytne», ALLC «Avangard»	p/e	850	830	800	870	850	855	875	900	842
Kitsmanskyi district										
Farm «Ivankivtsi»	p/f	-	-	-	-	-	-	-	850	873
Agricultural Production Co-operative «Zoria»	p/f	-	-	815	815	795	800	800	830	810
Ivano-Frankivsk region										
Rohatyn district										
LLC «Toro»	p/f	-	-	-	-	-	-	-	850	850
Horodenkivskyi district										
Private Farm «Potochyshche»	p/f	780	850	800	850	800	850		870	821
Kosiv district										
Private Farm «Bohdan»	p/f	-	-	-	-	850	850	-	865	850
Farm «Zarichchia»	p/f	-	-	-	-	-	-	-	850	850

The newly created population of meat-based polled Simmental cattle is characterized by the following indicators: the live weight of adult cows is 545-650 kg; the milk yield for 210 days is 196-225 kg; the growth rate of young animals for fattening is 950-1150 g; the carcass weight of bulls at the age of 18-24 months is 265-275 kg, as well as the slaughter yield is 60-62%.

Analyzing the data of scientific results of the research having been conducted in the State Research Farm «Chernivetske» on the mother-stock of Bukovyna zonal type meat-based polled Simmental cattle having the well-developed limbs with sufficiently pronounced joints and tendons, the small strong hooves with a shiny horn and a good acclimatization to all climatic zones of the Western region of Ukraine.

The further research on breeding work will be conducted by the scientists of Bukovyna in the State Research Farm «Chernivetske» in order to increase the rearing of this type of beef cattle and the use of existing purebred mother-stock to reproduce the main herd in different climatic zones of the Carpathians.

Therefore, in the State Research Farm «Chernivetske» for breeding heifers of a new population of polled Simmental cattle, the livestock in the amount of 35 heads was evaluated by phenotype, genotype and technological characteristics, taking into account the live weight, which was 215 kg at the age of 7 months, while the average daily gains were 800-850 g in the period from their birth to the first insemination in the foothills of the Bukovyna region.

The studies have shown that in the future the breeding of meat-based Simmental cattle in the herd of the State Research Farm «Chernivetske» will be carried out in the direction of consolidation using the existing purebred mother-stock for the reproduction of animals of a new population Bukovyna zonal type with the following genotype (Simmental Canadian$^{3}/_{4}$ Simmental Austrian$^{1}/_{8}$ Simmental German$^{1}/_{8}$ Simmental American$^{1}/_{16}$) for rearing in different climatic zones of the Carpathians. According to the results of the research, it was determined the average live weight of cows of a new generation Simmental cattle in the State Research Farm «Chernivetske», which was on average 652 kg (2019) at the age of 5-7 years (121 heads); it was by 40 kg (6.8%) more than in 2018.

Thus, when creating the new genotype (Simmental Canadian$^{3}/_{4}$ Simmental Austrian$^{1}/_{8}$ Simmental German$^{1}/_{8}$ Simmental American$^{1}/_{16}$) a great importance was attached to the formation of the herd structure by age and live weight of animals in the State Research Farm "Chernivetske".

According to the results of the research, it was determined the live weight of the posterity of bulls in the most productive genotype (Simmental Canadian$^{3}/_{4}$ Simmental Austrian$^{1}/_{8}$ Simmental German$^{1}/_{8}$ Simmental American$^{1}/_{16}$), which was 225 kg at the age of 210 days ($P<0.001$) (reliability criterion is 2.92). The posterity with the worst genotype with different blood (Simmental Canadian$^{3}/_{4}$ + Simmental Austrian$^{1}/_{8}$ + Simmental American$^{1}/_{16}$) had the live weight of less than 67% (td=5.31), while the posterity with an intermediate genotype took the middle position (td=4.1) in the herd of the State Research Farm «Chernivetske» breeding in the foothills of the Carpathian region of Bukovyna.

According to the results of many years of breeding work, it has been determined that the linear and mass

dimensions of Bukovyna zonal type meat-based Simmental cattle of a new population increase with the raise of their heredity in the productively created new genotype (Simmental Canadian$^{3}/_{4}$ Simmental Austrian$^{1}/_{16}$ + Simmental German$^{1}/_{8}$ + Simmental American$^{1}/_{16}$). Their live weight increased by 15.5 kg, the height at withers – by 3.1 cm, the chest circumference – by 4.8 cm, the oblique length of the torso and buttocks – by 1.7 and 2.1, respectively, and the overall dimensions – by 13.5 cm.

During the breeding work it has been found that the growth rate in this type of repair heifers from birth to 7 months of age in a new productive genotype (Simmental Canadian$^{3}/_{4}$ Simmental Austrian$^{1}/_{16}$ + Simmental German$^{1}/_{8}$ + Simmental American$^{1}/_{16}$) is 15.7%; they reliably predominate by 3.4% ($P<0.001$) their improved peers of the genotype (Simmental Canadian$^{25}/_{32}$ + Simmental Austrian$^{1}/_{16}$ + Simmental German$^{1}/_{8}$ + Simmental American$^{1}/_{32}$). The studies have shown that a correlation in repair heifers with the final genotype Simmental Canadian$^{3}/_{4}$ Simmental Austrian$^{1}/_{16}$ + Simmental German$^{1}/_{8}$ + Simmental American$^{1}/_{16}$ between the live weight during the period of rearing was low and negative: at birth $r=-0.13$ ($P>0.095$); at 7 months of age $r=-0.02$ and at 12 months of age $r=-0.05$ ($P>0.095$).

In the process of a long-term breeding work it has been found that in the productive meat herd with two created genotypes in the State Research Farm «Chernivetske» there is a tendency to reduce the relative increase in live weight of animals with age. Thus, it was the lowest in the posterity of 12-18 months in the physiological period of animal development, which was (25.3%) in the purebred heifers of the genotype Simmental Canadian$^{3}/_{4}$ Simmental Austrian$^{1}/_{16}$ + Simmental German$^{1}/_{8}$ + Simmental American$^{1}/_{16}$ and reliably prevailed by 4.5% ($P <0.001$) the improved genotype Simmental Canadian$^{25}/_{32}$ + Simmental Austrian$^{1}/_{16}$ + Simmental German$^{1}/_{8}$ + American$^{1}/_{32}$.

The studies determined the average live weight of bulls in different 5 lines from the date of birth to 7 months of age in the State Research Farm «Chernivetske», where the posterity of the ancestor bull-sire Forest 0899 line Achilles 369, American breeding, had the live weight of 235 kg at weaning, which was by 24.9 kg (12.2%) more than in the peers from the bull-sire Masquit 1822 line Signal 120, Austrian breeding.

Carrying out the breeding work in the herd of the State Research Farm «Chernivetske» indicates that the new created genotypes and their linear genealogical combination of three most outstanding productive lines of meat-based polled Simmental cattle, namely Achilles 369, Apricot 58311 and Signal 120, have high productivity, pass on their natural genes to their posterity and increase the growth energy by 18-21% in the foothills of the Carpathian region of Bukovyna. The heifers in the genotype (Simmental Canadian$^{3}/_{4}$ Simmental Austrian$^{1}/_{16}$ + Simmental German$^{1}/_{8}$ + Simmental American$^{1}/_{16}$), having been obtained from bulls-sires of German breeding (Mumbim 9214, Havrosh 9347, Bombay 9212 and Matros 9217), were evaluated. They are characterized by higher maturity and the age of fertilization, which is by 23.5 days shorter than in the daughters from bulls-sires of the genotype Simmental Canadian$^{3}/_{4}$ + Simmental Austrian$^{1}/_{8}$ + Simmental American$^{1}/_{16}$.

During the breeding period, the insemination rate of cows in the herd of the State Research Farm «Chernivetske» was studied. After the first insemination it was 83.8% in the genotype Simmental Canadian$^{3}/_{4}$ Simmental Austrian$^{1}/_{16}$ + Simmental German$^{1}/_{8}$ + Simmental American$^{1}/_{16}$, which was by 7.1% more than in the cows of the genotype Simmental Canadian$^{3}/_{4}$ + Simmental Austrian$^{1}/_{8}$ + Simmental American$^{1}/_{16}$. The studies have determined a clear pattern of the influence of live weight and age of the new generation repair heifers during fertilization on the reproductive abilities of cows of meat-based Simmental cattle in the most productive genotype (Simmental Canadian$^{3}/_{4}$ Simmental Austrian$^{1}/_{16}$ + Simmental German$^{1}/_{8}$ + Simmental American$^{1}/_{16}$). An increase in age and live weight of animals during the first insemination leads to a decrease in reproductive abilities of the new generation cows in the Ukrainian Carpathians.

In Chernivtsi and Ivano-Frankivsk regions, the work to create a population of Bukovyna zonal type meat-based Simmental cattle in the direction of increasing the genetic potential of productivity is underway in basic and subsidiary farms of the public sector of different forms of ownership in the Carpathian region of Ukraine (Table 3).

The analysis of the data (Table 3) gives grounds to conclude that the cows of the new generation in the rest of farms are inferior to the animals of the State Research Farm «Chernivetske» in terms of live weight, milk productivity and other biometric indicators.

Thus, the fertility index of the cows of meat-based polled Simmental cattle in the State Research Farm «Chernivetske», having been obtained from the heifers fertilized at the age of 15-18 months at a live weight of 395-420 kg, is 45.3%, while it is 35.5% from those fertilized at the age of 21 months and older at a live weight of 435-450 kg ($P>0.095$). The coefficient of reproductive ability is 0.87 and 0.76, respectively ($P>0.95$).

Certain differences were determined in the new population meat-based Simmental cattle of different promising genotypes in the herd of the State Research Farm «Chernivetske», where the live weight of heifers of meat-based polled Simmental cattle on the date of birth was 31.2 ± 0.45 kg in the genotype (Simmental Canadian$^{25}/_{32}$ + Simmental Austrian$^{1}/_{16}$ + Simmental German$^{1}/_{8}$ + Simmental American$^{1}/_{32}$.), while it was 33.5 ± 0.45 kg in the genotype (Simmental Canadian$^{3}/_{4}$ + Simmental Austrian$^{1}/_{16}$ + Simmental German$^{1}/_{8}$ + Simmental American$^{1}/_{16}$). These indicators were respectively 89.2 ± 1.25 kg and 91.6 ± 1.37 kg at the age of 3 months old, 185.0 ± 0.78 kg and 195.7 ± 0.80 kg at the age of 6 months old, 270.5 ± 1.15 kg and 277.3 ± 1.18 kg at the age of 9 months old, 303.3 ± 1.24 kg and 310.9 ± 1.78 kg at the age of 12 months old, 325.5 ± 1.35 kg and 350.1 ± 1.91 kg at the age of 15 months old, as well as 389.3 ± 2.34 kg and 405.8 ± 3.03 kg at the age of 18 months old.

Table 3

Live weight and milk productivity of first calving cows

№	Farm	Districts	n	Live weight, kg			Milk productivity, kg (210days)		
				M±m	δ	CV	M±m	δ	CV
Chernivtsi region									
1	State Research Farm «Chernivetske»	Hertsaivskyi	28	552	17.04	4.13	198.5	11.12	4.67
2	SOE «Rokytne», ALLC «Avangard»	Novoselytskyi	14	517	14.12	3.23	185.7	9.35	3.34
3	Farm «Ivankivtsi»	Kitsmanskyi	13	509	13.14	3.03	195.4	8.31	2.95
4	Agricultural Production Cooperative «Zoria»	Kitsmanskyi	8	513	15.04	3.17	191.8	7.34	1.97
5	Agricultural Production Private Cooperative «Peremoha»	Hertsaivskyi	15	495	14.06	3.56	187.6	8.75	2.31
	Total		78	513	14.41	3.51	191.4	8.85	2.95
Ivano-Frankivsk region									
1	LLC «Toro»	Rohatyn	35	515	13.8	3.13	195.7	8.78	2.12
2	Private Farm «Potochyshche»	Horodenkivskyi	18	500	12.3	2.89	195.5	9.12	1.97
3	Farm «Zarichchia»	Kosiv	10	495	15.7	3.15	187.3	8.92	2.45
4	Private Farm «Bohdan»	Kosiv	15	490	14.3	2.87	191.5	8.15	2.56
5	LLC «Levada»	Kolomyiskyi	7	500	11.7	2.31	197.5	8.75	1.97
Total			85	502	13.37	2.87	194.1	8.89	2.12
On average in all farms			163	508	13.89	3.19	192.7	8.87	2.53

A different relative increase in live weight of heifers of different genotypes of the created Bukovyna zonal type meat-based Simmental cattle in different physiological periods of cultivation was determined in the breeding work (Table 4).

Table 4

Relative gain of heifers' live weight, %

Indicator	Period, months					
	0-3	3-6	6-9	12-15	15-18	0-18
Genotype: Simmental Canadian$^{25}/_{32}$ + Simmental Austrian$^{1}/_{16}$ + Simmental German$^{1}/_{8}$ + Simmental American$^{1}/_{32}$						
X±Sx	115.2±2.35	108±3.01	32.5±0.65	19.7±0.45	9.8±0.41	795.8±12.31
Cv,%	24.3	26.7	18.6	29.8	41.3	12.8
Genotype: Simmental Canadian $^{3}/_{4}$ + Simmental Austrian $^{1}/_{16}$ + Simmental German $^{1}/_{8}$ + Simmental American $^{1}/_{16}$						
X±Sx	135.6±3.45	101.4±3.35	30.3±0.45	20.5±0.89	11.4±1.06	826.2±15.02
Cv,%	22.6	25.7	15.7	40.7	51.6	11.7

In terms of relative live weight gain, the repair heifers of the most productive genotype (Simmental Canadian$^{3}/_{4}$ + Simmental Austrian$^{1}/_{16}$ + Simmental German$^{1}/_{8}$ + Simmental American$^{1}/_{16}$) prevailed the heifers of the genotype (Simmental Canadian$^{25}/_{32}$ + Simmental Austrian$^{1}/_{16}$ + Simmental German$^{1}/_{8}$ + Simmental American$^{1}/_{32}$) for the period from birth to 3 months of age by 7.3% (P>0.99), from 9 to 12 months of age – by 1.2% (P<0.95), from 12 to 15 months of age – by 15.4% (P<0.95), from 15 to 18 months of age – by 17.4% (P <0.95) and from birth to 18 months of age – by 29.9% (P>0.99). Only between 9 and 12 months of age the best average indicators were reduced to 1.2% (P>0.99) and 0.9% (P<0.95).

It is noteworthy a very important production indicator for determining the average daily gains in different physiological periods, which were respectively 612.1 ± 0.0234 and 638.2 ± 0.0286 kg from birth to 3 months of age, 1052.7 ± 0.0374 and 1143.9 ± 0.0311 kg from 3 to 6 months of age, 653.6 ± 0.0314 and 0.640 ± 0.0414 kg from 6 to 12 months of age, 985.8 ± 0.0113 and 960.0 ± 0.0241 kg from 9 to 12 months of age, 835.5 ± 0.0132 and 808.1 ± 0.412 kg from 12 to 15 months of age, 708.9 ± 0.0293 and 744.4 ± 0.0552 kg from 15 to 18 months of age, as well as 795.8 ± 0.0049 and 850.0 ± 0.0068 kg from birth to 18 months of age.

It was determined that the coefficient of live weight varied in the range of 3.5-12.2% in the new generation heifers of meat-based Simmental cattle, having different intensity of its growth in certain physiological age periods of rearing. Its indicators increase until 6 months of age, and then decrease, which is consistent with the research of scientists from other institutions. In terms of absolute increase in live weight in some periods, the heifers reliably prevailed their peers of the combined type Simmental cattle, in particular, by 13.7

kg (P>0.999) from birth to 3 months of age, by 8.7 kg (P>0.999) from 12 to 15 months of age, and by 31.3 kg (P>0.999) from birth to 18 months of age. The difference was insignificant in other age periods.

In terms of relative increase in live weight the heifers of the new generation meat-based Simmental cattle prevailed the local Simmental breed by 15.1% (P>0.99) for the period from birth to 3 months of age, by 3.5% (P<0.95) from 9 to 12 months of age, by 11.4% (P<0.95) from 12 to 15 months of age, by 17.4% (P<0.95) from 15 to 18 months of age, and by 48% (P>0.99) from birth to 18 months of age under the conditions of different climatic zones of Bukovyna region.

In the conducted breeding research it was determined the productivity of two adjacent cows' generations (n=18) of mothers-daughters ± mothers, in which the milk productivity was 195.9 kg for the first lactation and 219.8 kg for the third lactation at probability (P>0.001), while the milk productivity of mothers-daughters ± mothers in the herd of the State Research Farm "Chernivetske" was by 19.3 kg more for the first lactation and by 2.4 kg more for the third lactation at probability (P>0.005).

The growth rates of repair heifers of meat-based polled Simmental cattle were studied. At the age of 18 months old, their live weight was 395-405 kg; the height at withers was 125-128 cm and the chest circumference was 180.7-181.0 cm. The live weight of adult cows was 545-650 kg, which exceeded the developed weight and linear standards with an index of legs length, stretching and chest. The indices of stretching and chest were higher by 9.3% (P<0.001), 3.9% (P<0.001) and 0.7% (P<0.05) and 7.6% (P<0.001), 4.3% (P<0.001) and 1.6% (P<0.001), respectively.

It was found that the first calving cows of line Achilles 351, American breeding, having been obtained from different lines, had significant differences in exterior and size of measurements. The first calving cows of line Signal 120, Austrian breeding, exceeded their peers in the height at withers by 5 cm (5.6%), in the chest depth by 8-9 cm (16.6%) and in latitudinal measurements by 3.8%, (6.1%), (16.9%). The similar advantage over the peers of other lines is observed in the first calving cows of line Achilles 351, which are kept in the herd and have, as a rule, a quite large and massive proportional body with the height at withers of 134.8 ± 0.22 cm, the well-developed deep (71.3 ± 0.15 cm) and wide (47.0 ± 0.20 cm) chests with the circumference of 195.4 ± 0.42 cm and the live weight of 675.4 kg.

The analysis of the linear measurements development in the exterior of the daughters of individual bulls-sires of line Achilles 351, American selection, found that the largest first calving cows in the herd of the State Research Farm «Chernivetske» were the daughters of the ancestors of purebred bulls-sires Forest 0899 (height at withers – 128.8 cm, oblique length of the torso – 149.4 cm, chest circumference – 171.9 cm, live weight – 468 kg), Ivora 1001 (height at withers – 17.0 cm, oblique length of the torso – 149.0 cm, chest circumference – 170.1 cm, live weight – 473.3 kg) and Micron 1351 (height at withers –125.7 cm, oblique length of the torso – 146.0 cm, chest circumference – 167.8, live weight – 443.3 kg).

The main economic indicators of the meat industry development demonstrate the stability and growth in the State Research Farm «Chernivetske» as for the breeding the new type meat-based polled Simmental cattle, as shown data in Table 5.

Table 5

Economic efficiency of a new type of meat-based Simmental

Indicator	Units of measurement	2007	2008	2009	2010	2011	2012	2013	2014	2019
Total livestock	heads	378	384	216	246	239	257	279	291	276
Including cows	heads	150	160	160	153	153	153	156	156	151
Production of meat	quintals	514	354	208	435	350	375	380	370	65
Daily gain on pastures	g	917	695	601	685	750	850	930	950	900
Sale of meat	quintals	518	342	02	325	365	355	345	336	345
Sale:										
of breeding young cattle by live weight	heads	43	27	5	1	28	21	22	22	25
	quintals	197	102	269	0.35	37.8	35.6	34.6	35.1	25.3
Cost of 1 quintal of gain	UAH	119.5	496.1	690	750	750	650	925	1100	1110

Since 2012, the State Research Farm «Chernivetske» of Bukovyna State Agricultural Research Station of the National Academy of Agrarian Sciences of Ukraine annually sells the breeding young cattle in live weight in the amount of over 300,000 UAH, which is 30% of profitability. An average monthly growth of 800-950 g for a full cycle of rearing with low feed costs of 7.8-8.5 feed units per 1 kg of gain is achieved.

Thus, the cost of beef production on the pastures of the State Research Farm «Chernivetske» in 2019 was 1,100 UAH, which was by 350 UAH more than in 2011. This affected the reduction in the cost of one feed unit.

The leading breeding plant in the Western region of Ukraine the State Research Farm «Chernivetske» of Bukovyna State Agricultural Research Station of the National Academy of Agrarian Sciences successfully sells more than 25 young cattle each year. In 2017, 50 heads of the first-class and elite breeding heifers were sold to the farms of different forms of ownership in the Carpathian region of Ukraine, which indicated a high demand for breeding cattle of a new type meat-based Simmental.

Thus, ensuring the prerequisites for profitable beef

cattle breeding is possible only on the basis of a rational combination of efficient using the production potential and the region's existing natural and climatic zones under the conditions of using a scientifically sound rational structure of sown areas, zonal specialization, introduction of intensive technologies for breeding, rearing, feeding and keeping animals in order to obtain a profitable meat industry in the Carpathian zone.

The studied economic evaluation of the efficiency of a new breeding achievement, Bukovyna zonal type meat-based polled Simmental cattle, showed that the income from the use of repair young animals at the expense of the breeding effect was 903,300 UAH. The sales revenue per head was 1,358 UAH and it was 4.59 UAH per 1 kg of carcass weight. This is confirmed by the actual results achieved in the farms engaged in the introduction of resource-saving technology for keeping beef cattle of zonal type meat-based polled Simmental.

In the future, in order to improve the economic efficiency of breeding a new type meat-based polled Simmental, it is planned to carry out the work aimed at increasing milk productivity, fertility of beef cows and calving, which will significantly increase meat productivity for the Carpathian region of Bukovyna.

Conclusions: 1. It has been found that the growth rate in this type of repair heifers from birth to 7 months of age in the genotype Simmental Canadian$^{3}/_{4}$ + Simmental Austrian$^{1}/_{16}$ Simmental German$^{1}/_{8}$ + Simmental American$^{1}/_{16}$ is higher; they reliably predominate by 3.4% ($P<0.001$) their improved peers of the genotype Simmental Combined$^{1}/_{32}$ Simmental Canadian$^{27}/_{32}$ Simmental Austrian$^{1}/_{32}$ Simmental German$^{3}/_{32}$ in the herd of the State Research Farm «Chernivetske».

2. It has been determined that a correlation in repair heifers with the final genotype Simmental Canadian$^{3}/_{4}$ Simmental Austrian$^{1}/_{16}$ + Simmental German$^{1}/_{8}$ + Simmental American$^{1}/_{16}$ between the live weight during the period of rearing was low and negative: at birth $r=-0.13$ ($P>0.095$); at 7 months of age $r=-0.02$ and at 12 months of age $r=-0.05$ ($P>0.095$).

3. The studies have determined that the linear and mass dimensions of a new population Simmental cattle increase with the raise of their heredity in the genotype Simmental Canadian$^{3}/_{4}$ Simmental Austrian$^{1}/_{16}$ + Simmental German$^{1}/_{8}$ + Simmental American$^{1}/_{16}$. Their live weight increased by 15.5 kg, the height at withers – by 3.1 cm, the chest circumference – by 4.8 cm, the oblique length of the torso and buttocks – by 1.7 and 2.1, respectively, and the overall dimensions – by 13.5 cm.

4. It has been found that the growth rate in the repair heifers of meat-based polled Simmental cattle from birth to 7 months of age in a new productive genotype Simmental Canadian$^{3}/_{4}$ Simmental Austrian$^{1}/_{16}$ + Simmental German$^{1}/_{8}$ + Simmental American$^{1}/_{16}$ is 15.7%; they reliably predominate by 3.4% ($P<0.001$) their improved peers of the genotype Simmental Canadian$^{25}/_{32}$ + Simmental Austrian$^{1}/_{16}$ + Simmental German$^{1}/_{8}$ + Simmental American$^{1}/_{32}$ in the State Research Farm «Chernivetske».

5. The studies have proved that in terms of relative live weight gain, the repair heifers of the most productive genotype Simmental Canadian$^{3}/_{4}$ Simmental Austrian$^{1}/_{16}$ + Simmental German$^{1}/_{8}$ + Simmental American$^{1}/_{16}$ prevailed the heifers of the genotype Simmental Canadian$^{25}/_{32}$ + Simmental Austrian$^{1}/_{16}$ + Simmental German$^{1}/_{8}$ + Simmental American$^{1}/_{32}$ for the period from birth to 3 months of age by 7.3% ($P>0.99$), from 9 to 12 months of age – by 1.2% ($P<0.95$), from 12 to 15 months of age – by 15.4% ($P<0.95$), from 15 to 18 months of age – by 17.4% ($P<0.95$) and from birth to 18 months of age – by 29.9% ($P>0.99$). Only between 9 and 12 months of age the best average indicators were reduced to 1.2% ($P>0.99$) and 0.9% ($P<0.95$).

6. According to the results of work, it has been determined the average daily gains in the genotype Simmental Canadian$^{25}/_{32}$ + Simmental Austrian$^{1}/_{16}$ + Simmental German$^{1}/_{8}$ + Simmental American$^{1}/_{32}$ and in the genotype Simmental Canadian$^{3}/_{4}$ Simmental Austrian$^{1}/_{16}$ + Simmental German$^{1}/_{8}$ + Simmental American$^{1}/_{16}$, which were respectively 612.1 kg and 638.2 kg from birth to 3 months of age, 1052.7 kg and 1143.9 kg from 3 to 6 months of age, 653.6 kg and 0.640 kg from 6 to 12 months of age, 985.8 kg and 960.0 kg from 9 to 12 months of age, 835.5 kg and 808.1 kg from 12 to 15 months of age, 708.9 kg and 744.4 kg from 15 to 18 months of age, as well as 795.8 kg and 850.0 kg from birth to 18 months of age in the foothills of the Carpathian region of Bukovyna.

7. The studied economic evaluation of the efficiency of a new breeding achievement, Bukovyna zonal type meat-based polled Simmental, showed that the income from the use of repair young animals at the expense of the breeding effect was 903,300 UAH. The sales revenue per head was 1,358 UAH and it was 4.59 UAH per 1 kg of carcass weighty in the prices of 2019.

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THE STATE OF NATURAL FODDER MEADOWS OF THE EASTERN PODILLYA OF UKRAINE IN MODERN ECOLOGICAL CONDITIONS OF THE ENVIRONMENT

Abstract.
The article presents an analysis of the state of natural fodder meadows of the Eastern Podillya of Ukraine. It was found that in the conditions of dry lowland meadows the safest and most suitable for providing herbivores with plant biodiversity are normal land.

Keywords: *agricultural landscapes, heavy metals, soil, land, natural forage lands, lead, cadmium, zinc, copper.*

In Ukraine, natural forage lands cover an area of about 6.7 million hectares, of which about 4.6 million hectares are pastures, up to 2.3 million hectares - hay and about 0.9 million hectares - swamps. In the Forest-Steppe zone there is about 10% of natural fodder lands from the total area of agricultural lands.

In the Forest-Steppe of Ukraine, natural forage lands cover an area of about 2.1 million hectares, which is 3.4% of the total area of this natural-climatic zone. The forest-steppe zone includes mainland and floodplain meadows.

Natural forage lands are a source of plant food for both domestic and wild ruminants. Although natural plant communities are less nutritious than the vegetation of cultivated pastures, however, its use is costly, which plays an important role in providing food to the population of Ukraine. Modern use of natural lands provides a sufficiently cheaper feed, the possibility of

free grazing. In addition, the vegetation of natural forage lands dramatically reduces soil erosion and is one of the factors stabilizing disturbed agricultural landscapes [7].

As part of the plant groups of natural fodder meadows, 71% has fodder value, which includes cereal legumes, sedge and herbaceous groups. Cereal group of phytocenoses includes 104 species, which is a percentage of 7.5%, which have different fodder value. 35 species of plants are characterized by high fodder value, while low - 23 species [3].

The legume group of phytocenoses of natural forage lands includes 79 species, which is 5.7%. Sedge vegetation includes 95 species (6.9%). This vegetation is characterized by low forage quality. There are 39 highly digestible species of natural forage lands, which is 2.8%. The poisonous plants grow among the natural fodder meadows, their number reaches 83 species (4.9%) and 59 (4.2%) harmful species that negatively affect the economic value. Natural forage lands include 61 species of vitamin-bearing plants, 53 species of plants containing tannins and 42 species containing essential oils [9].

It is known that the plant phytodiversity of natural forage lands is constantly undergoing certain changes, among which synthetic changes dominate (overgrowing of reservoirs, sands, landslides). Demutation changes have also been identified, which to some extent restore the original groups of plant biodiversity. Among modern demutation changes, demutation and anthropogenic-demutation changes are distinguished. Due to the actual demutation changes, the anthropogenic impact on the restoration of plant diversity of natural forage lands is insignificant and has characteristic changes close to natural ones [10].

Analysis of geobotanical survey of natural forage lands of the Forest-Steppe of Ukraine showed that they are in unsatisfactory condition due to high anthropogenic load and need to be restored [5]. According to the coenotic structure, the studied lands include mainly cereals and cereal-herbaceous, less often - cereal-sedge, sedge-herbaceous, herbaceous and even less - cereal-legume and monodominant legumes, so they need radical restoration in some areas. A perspective direction of recovery of natural forage lands is the optimization of biotechnology of growing meadows, which is based on the use of low-cost energy-saving technologies [1].

Energy-saving technologies consist in the selection of individual species and grass mixtures, the application of fertilizers, modes of use of natural forage lands and the establishment of their impact on the composition, structure and productivity of grasslands, forecasting their development.

Analyzing the plant phytodiversity of natural forage lands of the Forest-Steppe zone, it should be noted that the largest share is occupied by cereals, in particular: cocksfoot grass (Dactylis glomerata), timothy grass (Phléum praténse L.), awnless brome (Bromus inermis), tall oat grass (Arrhenatherum elatius), meadow grass (Poa pratensis L.), creeping bent (Agrostis stolonifera), reed canary grass (Phalaris arundinacea) and others.

Among the vegetation that grows on natural fodder meadows and has a high fodder value, it is necessary to single out meadow clover (Trifolium pretense), pink clover (Trifolium hybridum), white clover (Trifolium repens), birds-foot trefoil (Lotus corniculatus) and timothy grass (Phléum praténse L.), cocksfoot grass (Dactylis glomerata) and pasture ryegrass (Lolium perenne) (cereals).

Anthropogenic load is typical for natural forage lands of Ukraine, especially in the conditions of urbanized territories. The main sources of pressure on natural ecosystems, including forage lands, are significantly affected by industry, motor wastewater and household waste, as well as agricultural production, which is characterized by excessive intake and biosphere of toxic elements. Among a large number of toxic elements, heavy metals occupy a prominent place.

In particular, there is an increased supply of lead, cadmium, zinc, copper and others. Among these heavy metals, zinc and copper are at the same time microelements, which are part of biocatalysts and bioregulators of the most important physiological processes and are part of individual protein components. However, the entry of heavy metals into living organisms above acceptable levels has a negative impact.

Once in the atmosphere, heavy metals eventually settle on the surface of the lithosphere, contaminating its components. Under such conditions, the soil is the main source of heavy metals, from which heavy metals in the food chain migrate into the vegetation, reducing its quality and safety. The predominant amount of heavy metals that enters the soil is concentrated mainly in its upper layer, which is characterized by high fertility. Heavy metals in the soil are fixed in the humus layers from where, being in exchange form, they are quickly included in the cycle and spread in the biome. The intensity of movement of heavy metals depends on many factors, in particular, the content of organic matter, soil pH, mechanical and mineral composition, and others. Chernozems are characterized by the highest sorption capacity, relatively lower - gray-forest and sod-podzolic soil.

According to various sources in the soils of the Forest-Steppe of Ukraine, the average concentration of mobile forms of cadmium in conditions of local pollution is 0.12 mg / kg, lead 10 mg / kg, zinc 2.8 mg / kg and copper 7 mg / kg.

Man-made activity of the population, which grows from year to year, leads to an increase in the environment of various harmful substances, in particular, heavy metals, which in metabolic form, move in trophic chains from soil to vegetation, reducing the quality and safety of food [2].

Powerful sources of environmental pollution by heavy metals are complexes: mining, metallurgy, engineering, chemical, transport, agro-industrial, housing and communal, and others [6]. It is known that mine effluents and water after mining in mines contain a number of pollutants, among which the most dangerous are heavy metals. In steelmaking, up to 40 kg of solid particles, including Mn, Cu, Zn, Cd and Pb compounds, enter the atmosphere when only one ton of steel is smelted. Powerful amounts of heavy metals also enter

the environment through chemical production, in particular from wastewater, in which compounds of cadmium, lead and zinc are found. Rapidly growing sources of environmental pollution today are vehicles, agricultural production and industrial waste. In agricultural production, especially in crop production, mineral fertilizers are a powerful source of heavy metals in the environment.

It is known that the number of vehicles has grown rapidly in recent years, which has significantly increased the power of man-made impact on the environment. At the same time, the number of facilities serving it is growing, which is also a source of environmental pollution by various toxicants. The main ones are transport companies, bases of road construction equipment, garages, parking lots, gas stations, service stations [2].

The objects of pollution from the exploitation of transport vehicles are air, water, soil, as well as vegetation, especially near highways, where about 20% of gaseous emissions are deposited, creating local pollution. The predominant share of emissions from motor vehicles is concentrated on the soil surface, from where it is included in the form of mobile forms in trophic chains, accumulating in the phytomass.

The accumulation of toxicants in soils leads to their degradation, which is accompanied by toxic effects on plants, causing a decrease in their reproductive quality. Quite a noticeable man-caused load of vehicles was found on the soils of the roadside, which is accompanied by their contamination with heavy metals [8]. The intensity of soil pollution by emissions from mobile sources depends on the number of vehicles, usually higher in the city and lower outside.

There is a constant migration of substances in the soil and their transfer over long distances, including plants [4]. There is a clear relationship between the level of heavy metals in the soil and their accumulation in crops. The soil intensively accumulates cadmium, zinc, lead and copper. Heavy metals that got into the soil mainly accumulate in its near-surface layer 0–10 and 0–20 cm [5]. A significant source of soil contamination with heavy metals is the systematic application of fertilizers and pesticides, which can increase the concentration of these metals in the soil. Within 90% of heavy metals from their total supply of mineral fertilizers accumulates in the soil, and the rest is included in the cycle and enters the plants and their products. It is known that the largest amount of heavy metals is contained in phosphorus fertilizers, relatively less in potassium and nitrogen. It was found that during the cultivation of winter rape and sunflower with a total area of 405370 ha with mineral fertilizers annually gets into the soil about 908 kg of lead and 214 kg of cadmium [7].

Among the large number of toxicants that enter the environment as a result of man-made activities of the population in terms of revenue and toxicity are heavy metals, mobile forms of which are in constant circulation [10]. Heavy metals are characterized by a density of more than 5 g / cm3 and an atomic mass of 40. Heavy metals include trace elements, in particular Zn and Cu, which are toxic in high concentrations. The greatest attention is focused on the study of the cycle of Zn, Pb, Cd and Cu in the environment.

At the same time, it is necessary to take into account that the microelements B, Na, Cl, V, J, Mn, Co, Cu, Zn and Mo are indispensable for maintaining the physiology of vital activity of organisms in microconcentrations (less than 0.001%). Conditionally necessary, present in plants in different quantities are Li, F, Al, Si, Ag, Ti, Cr, Ni, Se, Sr, Cd and Pb. Their usefulness or irreplaceability has not been conclusively proven. Instead, the toxicity of many of these elements has been unequivocally proven to enter plants in increased quantities. In terms of phytotoxicity, heavy metals at the same concentrations are arranged in the following sequence: Cd> Ni> Zn> Mn> Cu> Pb.

It is established that heavy metals in the soil environment are in exchangeable and non-exchangeable forms. Non-exchangeable forms of heavy metals are those that bind to soil minerals and are inaccessible to plants. Metabolic forms of heavy metals are in the free state, so constantly migrate in the system soil - plants and their products. Depending on the acidity of the soil, heavy metals in the soil can change from one form to another. In particular, the high acidity of soils increases the migration of heavy metals, turning them into more accessible forms [5].

Natural forage lands as a component of the natural environment are constantly man-made by modern sources of pollution, which increases the risk of their productive use. Of particular concern is the increase in soil inputs with the subsequent inclusion in plant migration chains of toxicants such as cadmium and lead, which can accumulate tens of times or more in the phytomass compared to soils. The critical areas of natural fodder meadows today are those that are close to the sources of pollution, which requires constant control over the quality and safety of plant raw materials [8].

Materials and methods of research. The research was carried out in the conditions of the Eastern Podillya of Ukraine on gray forest soils in the conditions of absolute, normal lands and lands of excessive humidification within the limits of technogenic emissions.

Table 1

Content of mobile forms of heavy metals in soils of natural forage lands, mg / kg (on average for 2016-2018 based on absolutely dry matter), (n = 4, M ± m)

Research material	Lead	Cadmium
	Average	Average
Soils of absolute land	2,90±0,07**	0,48±0,03**
Soils of normal land	2,96±0,06**	0,49±0,05**
Land soils of excessive moisture	3,20±0,02	0,51±0,047

The content of lead in the soils of absolute land was lower than the MPC by 2.06 times, and cadmium by 1.45 times. In soils of normal land in the study areas, the concentration of lead ranged from 2.8 mg / kg to 3.1 mg / kg, while cadmium ranged from 0.47 mg / kg to 0.51 mg / kg. The content of lead and cadmium in the soils of normal land was lower than the MPL (Maximum permissible level) by 2.02 times and 1.42 times, respectively. In the conditions of land of excessive moisture in the studied areas, the content of lead in the soil ranged from 3.1 mg / kg to 3.3 mg / kg, cadmium from 0.49 mg / kg to 0.53 mg / kg. The content of lead and cadmium in the soils in these areas was lower than the MPC by 1.87 times and 1.37 times, respectively.

The highest level of lead and cadmium pollution (Fig. 1) was characterized by soils of excessively moist soils, relatively lower than normal dry soils and absolute dry soils. Thus, the concentration of lead and cadmium in the soils of the lands of excessive moisture was 1.1 times and 0.6 times higher, respectively, and 1.08 times and 1.04 times higher in comparison with the absolute and normal lands. The concentration of zinc in the soils of absolute drylands (1) ranged from 9.3 mg / kg to 14.2 mg / kg, and copper from 0.14 mg / kg to 0.17 mg / kg. The content of zinc and copper in the soils of absolute land on average in the studied areas was lower than the MPC by 2.0 times and 20 times, respectively.

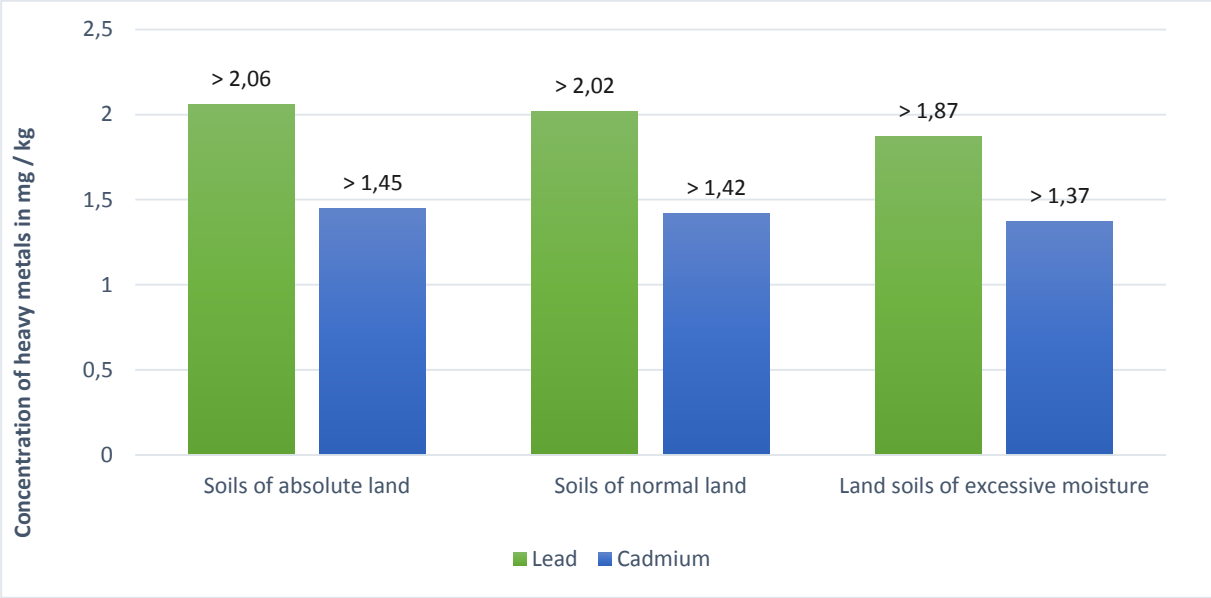

Fig. 1. Comparative assessment of the content of heavy metals in the soil to the MPC, times

Note. The maximum concentration limit for lead is 6.0 mg / kg, cadmium is 0.7 mg / kg

In soils of normal land, the content of zinc ranged from 10.5 mg / kg to 14.7 mg / kg, and copper from 0.18 mg / kg to 0.19 mg / kg. The content of zinc and copper was lower than the MPC by 1.84 times and 16.6 times, respectively. The content of heavy metals in the soils of the lands of excessive moisture was on zinc in the range from 17.2 mg / kg to 20.1 mg / kg, and on copper from 0.19 mg / kg to 0.21 mg / kg. The content of lead and cadmium in soils was 1.25 times and 1.5 times lower than the MPC, respectively.

Table 2

The content of mobile forms of heavy metals (trace elements) in soils of natural forage lands, mg / kg (on average for 2016-2018 based on absolutely dry matter), (n = 4, M ± m)

Research material	Zinc	Copper
	Average	Average
Soils of absolute land	11,4±1,42***	0,15±0,07***
Soils of normal land	12,5±0,09**	0,18±0,03**
Land soils of excessive moisture	18,3±1,22	0,20±0,04

The highest levels of zinc and copper (Fig. 2) were characterized by soils of excessively moist soils, relatively lower - normal dry and absolute drylands. Thus, the concentration of zinc and copper in the soils of overmoistened drylands was 1.6 times and 1.33 times and 1.46 times and 1.11 times lower compared to absolute drylands and overmoistened drylands. That is, the soils of the land of excessive moisture had a high content of lead and cadmium, as well as zinc and copper.

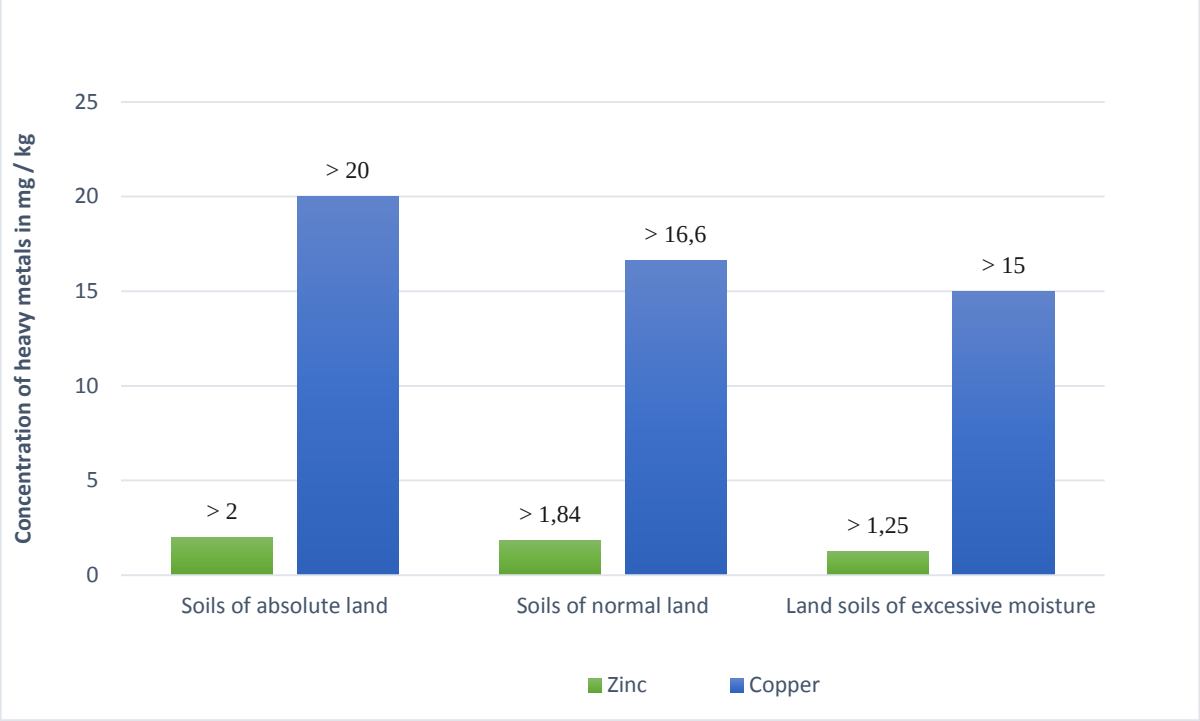

Fig. 2. Comparative assessment of the average content of heavy metals (trace elements) in the soil (for 2016-2018) to the MPC, times

Note. MPC for zinc - 23 mg / kg, copper - 3.0 mg / kg

The risk factor for lead in soils (Table 2) of natural forage lands ranged from 0.48 to 0.53. The highest risk factor for lead of 0.53 was in soils of excessively moist soils, relatively lower in 1.08 times and 1.1 times in soils of normal and absolute soils, respectively.

Table 3

The coefficient of danger of mobile forms of heavy metals in the soils of natural forage lands on average for 2016-2018

Research material	Lead			Cadmium		
	MPC	Actual concentration, mg / kg	The coefficient of danger	MPC	Actual concentration, mg / kg	The coefficient of danger
Soils of absolute land	6,0	2,9	0,48	0,7	0,48	0,68
Soils of normal land	6,0	2,96	0,49	0,7	0,48	0,79
Land soils of excessive moisture	6,0	3,2	0,53	0,7	0,49	0,72

The risk factor for cadmium in natural forage soils ranged from 0.68 to 0.72. The highest risk factor for lead was also characterized by soils of overland moisture, relatively lower by 1.05 times and 1.3 times, respectively, soils of normal land and absolute land.

Table 4

The coefficient of danger of mobile forms of heavy metals (trace elements) in the soils of natural forage lands on average for 2016-2018

Research material	Zinc			Copper		
	MPC	Actual concentration, mg / kg	The coefficient of danger	MPC	Actual concentration, mg / kg	The coefficient of danger
Soils of absolute land	23	11,4	0,49	3,0	0,15	0,05
Soils of normal land	23	12,5	0,54	3,0	0,18	0,06
Land soils of excessive moisture	23	18,3	0,79	3,0	0,20	0,06

The risk factor for zinc in soils (Table 3) of natural forage lands ranged from 0.49 to 0.79. The highest risk factor for zinc was found in soils of excessive moisture, relatively lower in 1.46 times and 1.61 times in soils of normal and absolute soils. The coefficient of danger of copper in the soils of natural forage lands in the study area ranged from 0.05 to 0.06. In soils of land with excessive moisture and normal land, the risk factor for copper was 0.06. Whereas in absolute land soils the risk factor for copper was 1.2 times lower.

Conclusions. Analysis of the intensity of accumulation of heavy metals by dry lowland meadows in the

studied areas of Vinnytsia region showed that the content of lead in soils ranged from 2.9 mg / kg to 3.2 mg / kg, cadmium from 0.48 mg / kg to 0.51 mg / kg, zinc from 11.4 mg / kg to 18.3 mg / kg and copper from 0.15 mg / kg to 0.20 mg / kg. It did not exceed the MPC, which is respectively 6.0 mg / kg; 0.7 mg / kg; 23 mg / kg and 3.0 mg / kg. The highest level of accumulation of lead, cadmium, zinc and copper in the soils was observed in the lands of excessive moisture, relatively lower in the conditions of normal and absolute lands.

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