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FORMATION OF PROFESSIONAL COMPETENCE OF FUTURE AGRONOMISTS IN THE PROCESS OF STUDYING THE COURSE «HARVEST PROGRAMMING»

Annotation

Introduction. Actual at the present time is the awareness of the process of forming professional competence, understanding why it is necessary to teach, how and what should be the technology of learning to achieve the goal. Nowadays the specialists, possessing creative professional and managerial thinking, operating with market categories, terms and notions, able to solve successfully the problems of agrarian sector and to work effectively in difficult economic conditions, are needed for the modern stage of agrarian production development. All this causes the necessity of basic research on the problem of preparing students of agrarian universities for their industrial activity.

Purpose. The choice of this article is caused by the need to investigate the role of the subject "Harvest Programming" in the formation of professionality of future agronomists, i.e. specialists of the agrarian sector.

The research method consists of the theory of scientific cognition; conceptual provisions of psychology and pedagogy about the leading role of activity in the formation of personality, the unity of consciousness and productive activity of the subject in the learning process, the principles of professional orientation, the provisions of the role of continuing education in shaping professionalism of personality.

Research results. As a result of studying the educational subject the student must form integral, general, special and program competences. The program of the discipline " Harvest programming" is focused on deep learning of the basic principles of formation of programmed harvest; the influence of life factors on the formation of plant productivity; energy- and resources-saving technologies of growing crops: agrobiological, agrochemical and agronomic bases of harvest programming; types of programs for programmed harvesting and the conditions of their implementation.

Conclusions. In our opinion, the practical training of students should adhere to the following principles: theoretical and practical training should be organically coordinated with each other in content, practical training should cover all aspects of practical activities of the future profession, in the process of forming practical skills should take into account age and cognitive abilities of students, socially useful work, to which students are involved, which can follow the educational tasks.

Key words: harvest programming, lectures, practical, independent work, professional competence.

Introduction

In Ukraine, as well as in most countries of Europe and the world as a whole, there are currently discussions about how to provide a person with the necessary knowledge and skills to meet his harmonious interaction with the technologically developed society. Actual at the present time is the awareness of the process of forming professional competence, understanding why it is necessary to teach, how and what should be the technology of learning to achieve the goal. Nowadays the specialists, possessing creative professional and managerial thinking, operating with market categories, terms and notions, able to solve successfully the problems of agrarian sector and to work effectively in difficult economic conditions, are needed for the modern stage of agrarian production development. All this causes the necessity of basic research on the problem of preparing students of agrarian universities for their industrial activity.

So, the choice of this article is caused by the need to investigate the role of the subject "Harvest Programming" in the formation of professionality of future agronomists, i.e. specialists of the agrarian sector.

The process of professional training in educational organizations has, above all, directed to the formation of readiness for such activities, based on the individual's need for learning and improvement throughout life.

Solution of this problem implies orientation of future worker's training system to humanistic paradigm and personalized education, directed to student's achievement of professionalism in his activity.

The works of such scientists as V. Baidenko, M. Budnikov, V. Zbarsky, M. Diachenko, N. Kuzmina, D. Melnichuk, V. Fedtsov, A. Khutorsky and others have been devoted to this problem. Scientists have investigated the concept of "competence", "competence approach", as well as the organization of training aimed at the final result [1-3].

Research goal

Concludes in the substantiation of theoretical and methodological ideas and practical aspects of agrarian direction, analysis of features of classes and recommendations for improvement of teaching the discipline " Harvest Programming" in higher educational institutions of agrarian conjugation in the formation of professional competence of future agronomists.

The object of the study - professional training of future specialists of the agrarian sphere acquired when teaching the discipline "Harvest Programming". Subject of the study - the content, forms and methods of formation of professional competence of specialists of the agrarian sphere acquired while teaching the discipline " Harvest Programming".

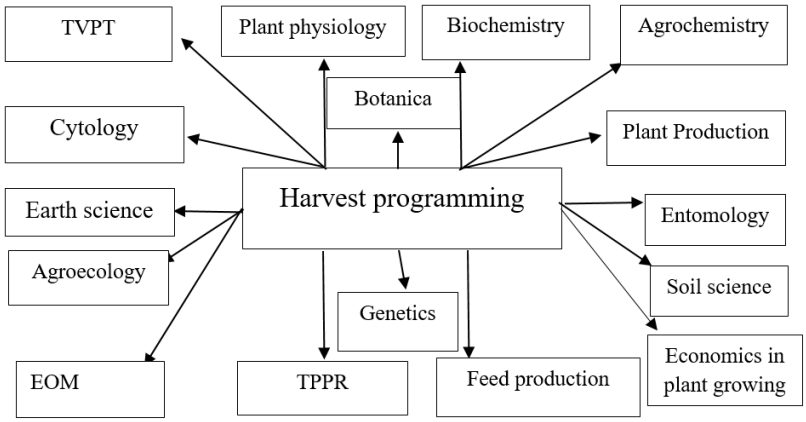
The research goal

The research method consists of the theory of scientific cognition; conceptual provisions of psychology and pedagogy about the leading role of activity in the formation of personality, the unity of consciousness and productive activity of the subject in the learning process, the principles of professional orientation, the provisions of the role of continuing education in shaping professionalism of personality; the unity of cognitive theoretical and practical activities; pedagogical systems of development and self-development of personal professional qualities in the process of activity; theories of individual, personality- and competence-oriented approaches to the training of future specialists in the agricultural sphere in the educational institutions of higher education.

Research results

Educational component of "Yield Programming" is aimed at obtaining by applicants one

of the important and universal competence - synthesis of achievements of a large number of related disciplines: plant science, morphology, systematics, microbiology, plant physiology, land science, agrochemistry, botany, phytopathology and others. (Picture 1). In turn, it is the basis for such sciences as economics and organization of agricultural production, which shows the strong interaction between all scientific directions.



Pic. 1. The structural scheme of interdisciplinary connections
Source: own research

The purpose of teaching the discipline - theoretical justification and practical implementation of the full use of soil and climate resources, the maximum accumulation of solar energy, genetic potential of zoned varieties, material and labor resources, obtaining economically justified crops through the introduction of energy and resource-saving technologies.

Further study of the discipline requires personal professional qualities of future specialists-agrarians, the introduction of innovative-pedagogical technologies, psychological and pedagogical training of teachers and masters of production training of higher educational institutions of agrarian profile [4].

In the implementation of practical training of students in our opinion should follow these principles: a) theoretical and practical training should be organically consistent with each other in content; b) practical training should cover all aspects of practical activity of the future specialty; c) in the process of forming practical skills and abilities should consider the age and cognitive abilities of students; d) practical training is carried out with the use of advanced equipment, modern technology and organization of agricultural production.

Integral competencies (IC): The ability to solve complex specialized problems and practical tasks in agronomy, involving the application of theories and methods of the relevant

science and characterized by complexity and uncertainty of conditions.

General Competencies (GC):

GC 3. the ability to think abstractly, analyze and synthesize.

Special (professional) competences (SC):

SC 5. Ability to evaluate, interpret and synthesize theoretical information and practical production and research data in the field of agricultural production.

SK 6. Ability to apply methods of statistical processing of experimental data related to technological and breeding processes in agronomy.

SC 8. Ability to solve a wide range of problems and problems in the process of growing crops by understanding their biological characteristics and using both theoretical and practical methods.

Program learning outcomes:

PLO 6. Demonstrate knowledge and understanding of fundamental disciplines to the extent necessary to possess relevant skills in the field of agronomy;

PLO 10. Analyze and integrate knowledge of general and specialized professional training to the extent necessary for specialized professional work in agronomy;

PLO 11. Initiate quick and expedient solutions to production problems in accordance with zonal conditions;

PLO 13. To design and organize measures of cultivation of high-quality agricultural production according to the current requirements;

PLO 14. integrate and improve the production processes of agricultural production in accordance with the current requirements;

PLO 15. Plan economically profitable production of agricultural products;

PLO 16. Organize productive and safe working conditions.

The program of the discipline " Harvest Programming" is focused on deep learning of the basic principles of programmed harvest formation; the influence of life factors on the formation of plant productivity; energy- and resourcesaving technologies of growing crops: agrobiological, agrochemical and agrotechnical bases of harvest programming; types of soft harvesting programs and conditions for their implementation (Table 1).

Table 1. Study plan for the academic discipline
Source: own research

№	Topic title	Forms of education and number of hours		Self-work, number of hours
		Lecture classes	Practical classes	
1	Scientific foundations of crop harvest programming and forecasting.	2	1	10
2	Basic methodological principles of harvest programming.	2	2	10
3	Agrobiological bases of harvest programming on FAR inputs	2	2	10
4	Agrochemical basis for harvest programming	2	2	12
5	Agrotechnical basis of programming	2	2	12
6	Harvest resource availability of individual crops by zones of Ukraine and efficiency of their use	2	2	12
7	Methodical features of harvest programming for irrigation	2	2	12
8	Complex effect of limiting factors and conditions.	2	1	12
	Total	16	14	90

Self-work of the student is the main means of mastering the educational material in the free time from the compulsory classes.

Self-work of the student is organized by issuing an individual list of questions and practical problems on each topic, which are not put to class processing and execution of individual assignments (in the form of calculations). Self-work of the student is one of the ways of active, purposeful acquisition of new for him knowledge and skills. It is the basis of his training as a specialist, provides entry into the of cognitive activity methods, interest in creative work, the ability to solve scientific and practical problems. Execution of the applicant's independent work provides, if necessary, consultations or assistance of an appropriate specialist. Educational material of the discipline, provided by the working program for mastering by the applicant in the process of independent work, is taken on the current and final control next to the training material, which was worked out during the classroom lessons. Organization of independent work of applicants provides: planning of the volume, content, tasks, forms and methods of control of independent work, development of educational and methodological support; performance of the

planned independent work by the applicant; control and evaluation of the results, their systematization, evaluation of the effectiveness of the applicant's independent work (Table 2).

Table 2. Types of self-study of the student
Source: own research

№	Type of self-study	Hours	Deadlines	Form and method of control
1	Preparation for lectures and practical classes	20	weekly	Oral and written questioning
2	Preparation of individual questions on the theme of the discipline	24	weekly	Oral and written questioning
3	Individual creative tasks (calculation works)	30	4 times a semester	Observation of performance, discussions, oral defense
4	Preparation for control works and tests	16	2 times a semester	Testing in the SOCRAT system
Total		90		

Individual assignments are performed by the student alone under the direction of the teacher according to an individual study plan.

Individual assignments:

Theme 1: Constituent components of crop patterns of field crops, photosynthetic potential (PP).

Theme 2: Leaf Surface Index (LSI), optimal feeding areas and seeding rates of field crops.

Theme 3: Calculation of programmable biological yield of winter wheat. Agrochemical model of the crop. Providing the implementation of the model of winter wheat with the maximum yield in the individual task using modern growing technologies.

Theme 4: Calculation of parameters of programmed biological yield of spring barley. Agrochemical model of the crop. Ensuring the realization of the model of spring barley with the maximum yield in the individual task by means of the modern cultivation technologies.

Theme 5: Calculation of parameters of programmed biological yield of corn on grain. Model of agrochemical support of the crop. Ensuring the implementation of the model of corn on grain with the maximum yield in the individual task by using modern cultivation technologies. Calculation of parameters of programmed biological yield of millet. Model of agrochemical

support of the crop. Providing the implementation of the model of millet with the maximum yield of the individual task by means of modern cultivation technologies.

Theme 6: Calculation of programmed biological yield parameters of winter rye. Model of agrochemical provision of the crop. Providing the realization of the model of winter rye with the maximum productivity in the individual task by means of modern technologies of growing.

Means of assessment and methods of demonstration of learning outcomes:examination; computational problems; presentations of the student and presentations at scientific events; presentations of the results of completed individual assignments; tests; control works [7].

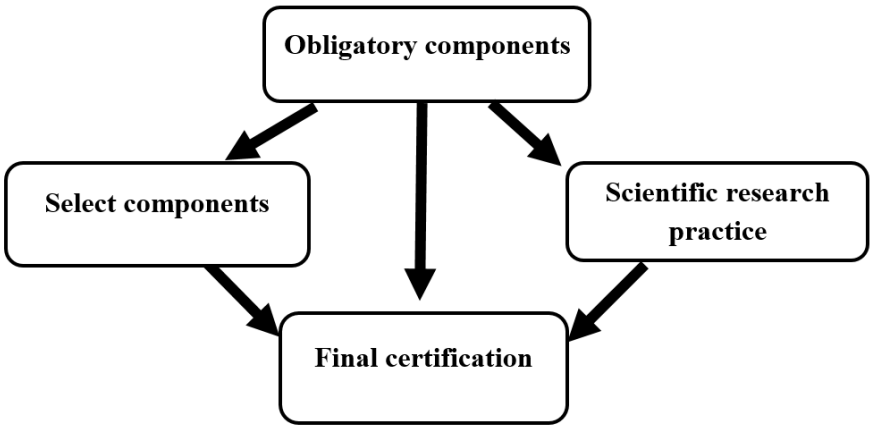
Monitoring and evaluation of learning outcomes. Distribution of scores between the forms of educational process organization and types of control activities: current control - total compliance with the declared competencies according to the results of practical and seminar classes - 40 scores (oral control: questioning, discussions, reports, communications on the topic and written control: test in written form, individual tasks, presentation of material on the topic in written form, etc.); milestone control (test in written form) - 10 scores; scientific, innovative, teaching, educational and other indicators of learning outcomes. Total 100 points. If a candidate during a semester on the results of current and boundary control has earned (received) less than half of the maximum mark in the discipline (less than 35 points), then he/she is not allowed to the exam. In addition, it is mandatory for the minimum number of points according to the results of the current and boundary control is the performance of the final control work by the student [7].

Forms of current and final control: control work, testing, presentations, exams.All principles of students' knowledge control are closely related to each other and together determine the requirements for the forms and methods of testing and evaluating knowledge, that is, determine the system of their control. Check knowledge, skills and abilities can be used in the usual forms of the educational process (lectures, practical classes) and on special, organized for this purpose, classes (protection of projects, tests and examinations). Control activities carried out by the lecturer on the course and out of class time, in addition to the general purpose, which pursues an objective assessment of students, should give the lecturer data to assess the work of his colleagues, who conduct practical classes. At the same time, it is important to pay attention to the creation of an effective system of knowledge control, because it shows the level of training of a qualified specialist in accordance with the requirements of the market. It is possible to achieve effective results in this case through the use of active teaching methods, which will allow to form and improve the practical abilities and skills, defined by the programs of academic disciplines, prepare for active implementation of the acquired knowledge, which significantly increases the quality of training of specialists.

Students in the study and mastering of academic disciplines of the educational and professional program "Agronomy" at the end pass the final certification (Pic.2).

Form of attestation of students of higher education. Attestation of graduates of the educational and professional program "Agronomy" of the first level of higher education in the specialty 201 Agronomy Field of Knowledge 20 Agrarian Sciences and Nutrition. Educational qualification: Bachelor of Agronomy. Professional qualification: Technologist in agronomy is held in the form of a comprehensive state examination or defense of the bachelor's thesis and is completed with the issuance of a document of the established form of awarding the degree of bachelor with the assignment of qualification [8]:

- educational: Bachelor of Agronomy;
- professional agronomy Technologist



Pic. 2. The structural-logical scheme of the educational-professional program
Source: [8]

The attestation is open and public.

Conclusions

In our opinion, the practical training of students should adhere to the following principles:

1. Theoretical and practical training should be organically coordinated with each other in content,
2. Practical training should cover all aspects of practical activities of the future profession,
3. In the process of forming practical skills should take into account age and cognitive abilities of students,
4. Socially useful work, to which students are involved, which can follow the educational tasks.

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PODILLYA BOTANICAL GARDEN AND BIOSTATIONARY OF VINNYTSIA NATIONAL AGRARIAN UNIVERSITY AS AN EDUCATIONAL, SCIENTIFIC AND PRODUCTION BASE IN THE PRACTICAL TRAINING OF FORESTRY AND HORTICULTURE SPECIALISTS

Summary

The main problems of practical training of students in Ukraine, which would form the professional competencies of future professionals, are outlined. Peculiarities of students' internship are determined. The conditions necessary for achievement of the set purposes and the decision of important tasks of practical preparation are investigated. It is stated that practical training is the basic value orientation of future professionals. The issues of formation and use of the biostationary as a training, scientific and production base in the training of specialists in the specialties "Forestry" and "Horticulture" in teaching subjects of professionally oriented disciplines are considered. The importance of the biostationary in the study of the prospects of using ornamental plant species for landscaping of various objects is substantiated. The species composition of the collections of ornamental plants of the biostationary of the Podillya Botanical Garden of Vinnytsia National Agar University has been systematized.
Key words: biostationary, collection, species, decorative forms, practical training

Introduction

The process of training forestry and horticulture specialists in VNAU is carried out both by highly professional scientific and pedagogical staff and in the presence of appropriate

educational and practical base for students - laboratories, garden centers, botanical garden, which together form a single educational complex. In the training of specialists in this field, contact with phytodiversity - plant groups is of great importance, which allows not only to know the theory, but also to obtain the necessary practical skills [8]. The Botanical Garden is a scientific and methodological base for conducting applied research by students and scientists of the university in the fields of floriculture, ornamental horticulture, forestry, forest reclamation, plant physiology, ecology, etc. In addition, the Botanical Garden is a base for the development of regional regional programs for landscaping, study of the eco-landscapes of Podillya, monitoring of endangered rare plants [5, 7]. The presence of such a facility in the structure of the university allows to maintain close ties with protected areas of Vinnytsia region and Botanical Gardens of Ukraine, to carry out scientific and practical cooperation with the regional horticultural station, the Institute of Horticulture NAAS and other institutions. The botanical garden, which includes an arboretum, greenhouse, exhibition area and biostationary, is the nearest floristic object of the university, and acts as a kind of "living green laboratory" for a number of disciplines, such as floriculture, decorative dendrology, forestry, topiary art, decorative art. with the basics of seed production, etc. [1, 2]. At our university, a biostationary, which is located directly on its territory, serves this purpose.

The biostationary was established in March 2015 on the basis of the Botanical Garden "Podillya" of Vinnytsia National Agrarian University in order to create collections of ornamental plants, conduct practical classes in professional disciplines, scientific work and for students to undergo training and industrial practices.

With the assistance of the university administration, as well as with the participation of teachers of the Department of Forestry, Horticulture, Horticulture and Viticulture, the biostationary is constantly replenished with new plant species through cooperation with a number of research institutions and garden centers.

Purpose, subject and research methods

The species composition of the biostation today is about 100 species, located on an area of 0.35 hectares. The systematic principle of selection and placement of species in collections has played a significant role in the taxonomy of plants not only for research but also for educational work. The nursery presents a large number of families that are found in the flora of Ukraine. In turn, each family is represented by species composition.

In the educational process, the nursery is the main object during the training practice and

practical classes. Completing the lecture course on plant taxonomy, students are introduced to the diversity of life forms, the quantitative composition of representatives of different angiosperm families in natural and directly growing form. They have the opportunity to visually study the morphological features of plants, as well as the characteristic morphological features of families, which are presented in the collection [3, 6].

In addition, students are introduced to plants that can be introduced into the culture (medicinal, ornamental), as well as wild useful plants mentioned in the lecture course, and other species that deserve attention [4].

The nursery also gives the opportunity to get acquainted with the plants of other regions of our country and other countries and continents, and to study the possibilities of introduction of some of them. During excursions through the nursery, students get acquainted with an interesting and rich collection of rare and relict species. That part of the biostationary, where tree-like and bush forms of plants are located (the so-called park-forest zone), makes it possible to study the ecological conditions of growth and mutual influence of different species on each other, their general development in the collection (Table 1).

Table 1. Species composition of tree-shrub and herbaceous plants of the biostationary of the Department of Horticulture, Horticulture and Viticulture
Source: own research

№	Name of plants	Botanical family	Quantity, items.
1	Picea abies	Pinaceae	3
2	Picea pungens		3
3	Picea pungens f. Glauca		6
4	Pinus strobus		3
5	Pinus sylvestris		1
6	Picea glauca		5
7	Pinus mugo		5
Total pieces			26
1	Taxus baccata L.	Taxaceae	6
2	Taxus media		5
Total pieces			11
1	Juniperus virginiana	Cupressaceae	7
2	Juniperus communis		5
3	Chamaecyparis Lawsoniana		10
4	Chamaecyparis pisifera		4

5	Juniperus horizontalis		5
6	Juniperus chinensis		2
7	Juniperus sabina		9
8	Juniperus excelsa		5
9	Thuja occidentalis f. Smaragd		9
10	Thuja occidentalis f. Pyramidalis		8
11	Platycladus orientalis		7
12	Thuja occidentalis L. f. globosa Gord.		4
13	Thuja occidentalis f. Teddy		1
14	Juniperus scopulorum		1
15	Thuja occidentalis Europe Gold		1
16	Thuja occidentalis f. Wagneri		1
17	Thuja plicata		1
Total pieces			80
1	Syringa vulgaris	Oleaceae	5
2	Syringa josikaea		5
3	Ligustrum vulgare		5
4	Forsythia suspensa		5
5	Forsythia europaea		5
Total pieces			25
1	Hydrangea arborescens	Hydrangea	5
2	Philadelphus coronarius		5
3	Deutzia scabra		5
Total pieces			15
1	Ginkgo biloba	Ginkgoales	6
1	Magnolia kobus	Magnoliaceae	2
2	Magnolia soulangeana		2
3	Magnolia acuminata		2
4	Magnolia tripetala		3
Total pieces			9
1	Berberis vulgaris	Berberidaceae	6

2	Berberis thunbergii		3
3	Berberis ottawensis		1
Total pieces			10

At present, 411 collectibles of tree and shrub flora are placed at the biostationary facility. Life forms of plants include: trees (21%) - 89 individuals, shrubs (79%) - 322 individuals. According to taxonomic affiliation, collection plants are classified into 70 species and intraspecific taxa, 36 genera, 18 families. Among them, 117 individuals are conifers (gymnosperms), 6 are deciduous (gymnosperms), and 288 are deciduous (angiosperms). The gymnosperm division is represented by the following families: *Cupressaceae* - 80, *Pinaceae* - 26, *Ginkgoales* - 6 and *Taxaceae* - 11 individuals. The angiosperms in the collection include the following families: *Rosaceae*– 62 individuals, *Buxales* - 30 individuals, *Fagaceae* - 5, *Hydrangea* - 15, *Oleaceae* - 25, *Celastraceae* - 9, *Caprifoliaceae* - 5, *Fabaceae* - 1, *Berberidaceae* - 10, *Rhamnaceae* - 5, *Aceraceae* - 6, *Magnoliaceae* - 9, *Bignoniaceae* - 3, and *Betulaceae* - 103 individuals.

The maximum number of individuals is represented by such taxa as *Córylus colúrna* - 103 individuals, *Buxus sempervirens* - 30, *Chamaecyparis Lawsoniana* - 10, *Spiraea japonica* - 15, *Chaenoméles japónica* 15 individuals. The vast majority of collectible tree and shrub plants are introducers. Among them are interesting representatives of the flora of China, Japan, the Caucasus, North America, the Middle East. In particular - *Ginkgo biloba, Prunus serrulata, Magnolia kobus, Magnolia soulangeana, Magnolia acuminata, Magnolia tripetala, Catalpa speciosa.* The collection of the arboretum includes Red Book trees and shrubs (2 species) - *Taxus baccata L, Syringa josikaea*.

Activities at the biostationary are not limited to the work associated with the formation of the collection. Phenological observations of woody and shrubby plants have been carried out since the beginning of the establishment of the biostationary, and active work is underway in the direction of cooperation with domestic botanical institutions, garden centers, in particular on the exchange of seeds and planting material. In addition, there are tours for a wide range of visitors.

On the basis of the biostationary research is conducted to study the basics of conservation, reproduction and use of plant resources. Under the guidance of teachers, students study ornamental plants, the technology of their cultivation and the care and use of various objects in landscaping. The collected results form the basis of graduation theses.

Conlusions

Living botanical collections of the biostationary play a cognitive role, broaden the horizons and are a supplement to nature excursions, which helps to create in students a broader idea of the richness of living forms of flora, which is especially important for future forestry and horticulture.

Biostationary is a reliable scientific basis for research on biological and morphological characteristics of plants, reproductive reproduction and the establishment of certain patterns of interspecific interaction of different species of ornamental plants. The practical significance of the biostationary in the study of the prospects of using ornamental plant species for landscaping of various objects.

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EFFECT OF FERTILISER NITROAMOFOSKA-M ON CROP CAPASITY AND MENTOR SOYBEAN VARIETY

Summary

The article presents the results of research on the study of a new complex mineral fertilizer Nitroamofoska-M. This mineral fertilizer is characterized by a content of N – 9,0 %, P_2O_5 – 18 %, K_2O – 22 %. Made on the basis of African phosphorites containing P_2O_5 of different degrees of digestibility (water-soluble form, form soluble in formic and citric acid). These phosphorites contain micronutrients Cu, Zn, Mn, Mo, Ni, S, Fe, etc., as well as due to the presence of calcium and magnesium carbonates, and in turn, according to their alkaline reaction (pH 8.8), their use provides reclamation effect – eliminates the need for soil liming.

The results of studies showed a significant effect on crop structure (number of seeds per plant, seed weight per plant, plant height, attachment of the lower bean) were the lowest in the control (without fertilizers), the highest – after Nitroamofoska-M introduction at 4 c/ha. Yield of Mentor soybeans under the influence of the complex fertilizer Nitroamofoska-M varied and over the years of research within the experiment was at the level of 2.51 – 4.06 t/ha. The lowest yield was indicated in the control (without fertilizers), where it was 2.51 t/ha, the maximum – in case of Nitroamofoska-M (4 c/ha) – 4.06 t/ha. The increase in yield of Mentor soybeans in case of Nitroamofoska-M (4 c/ha) was 1.55 t/ha, or 61.8%. The highest laboratory germination was observed on the variants with fertilizer 4 c/ha and 5 c/ha, the lowest – in case without fertilizer. In case of fertilizer, this figure was 98%. It was found that the first tubers began to form in the phase of the third leaf of the crop. The maximum number of them, within the experiment, was noted in case of Nitroamofoska-M application at the amount of 4 c/ha: in the budding phase the total number and number of active tubers was 49.7 and 45.4 units / plant; in the phase of full flowering – 54.2 and 53.7 units / plant, and a gradual decline in the phase of complete ripeness to 28.1 and

14.7 units / plant.

Key words: soybean, variety, mineral fertilizer, Nitroamofoska, productivity

Objectives, subject and methods of research

In the technology of growing crops, in particular soybeans, fertilization system is important. After all, despite the ability of a crop to meet a significant part of its nitrogen needs by biological fixation of this element from the atmosphere, formation of a proper grain yield requires an appropriate number of macro- and microelements that play an extremely important role in plant growth and development, however are not always present in the soil. Thus, according to the data results [6], about 70-90 kg of nitrogen, 15-20 kg of phosphorus, 30-40 kg of potassium, 8-10 kg of magnesium and 18-21 kg of calcium is used for 1 ton of soybeans formation. In turn, this crop leaves an average of about 60-150 kg/ha of biological nitrogen per 1 ha, which is used by subsequent crops by 90-100%, 20-25 kg/ha of phosphorus and 30-40 kg/ha of potassium [5; 6].

The objective of our research was to study the impact of complex fertilizer Nitroamofoska-M (manufacturer LLC "Tetra-Agro", town Chervonograd, Lviv Region) on the peculiarities of soybean productivity in the Western Forest-Steppe for two years (2017-2019) in the research field of the Department of Technology of Lviv NAU, based on the field research.

Size of the accounting area is 16 sq.m. Method of sowing – narrow-row (12.5 cm). Sowing rate is 550 thousand seeds / ha. Herbicides – Harness (2.5 l/ha) (soil), Basagran (2.5 l/ha) (insurance). Placement of options by randomization. Repeat the experiment – three times.

Mentor soybean variety, entered in the Register of Plant Varieties of Ukraine in 2013, was used in the research.

Mentor variety. Number of days sprouting-flowering– 47; number of days of sprouting-harvesting – 129; plant height – 77 cm; height of the lower bean attachment – 13.3 cm. Weight of 1000 seeds – 197 g; protein content ± 42.8%; oil content – 24%; energy of initial development – 8; resistance to lodging – 9; yield potential – 49 c/ha; recommended sowing density – 550 thousand seeds / hectare.

Mineral fertilizer in the form of water-soluble (entered in the State Register of Pesticides and Agrochemicals approved for use in Ukraine. State Register entry No. 10200 dd. 06.02.2017, certificate of state registration series A No.05777. Manufacturer LLC "Tetra-Agro", town Chervonograd, Lviv Region).

Nitroamofoska-M. Chemical composition: N – 9.0%, P_2O_5 – 18%, K_2O – 22%, CaO – 20%, S – 1.2% and microelement Na_2O – 0.5%, MgO – 0.5%, Fe – 0.1%, Zn – 97.8 mg / kg, Cu

– 6.5 mg / kg, Mn – 310 mg / kg. Made on the basis of African phosphorites containing P_2O_5 of different degrees of digestibility (water-soluble form, form soluble in formic and citric acid). These phosphorites contain micronutrients Cu, Zn, Mn, Mo, Ni, S, Fe, etc., as well as due to the presence of calcium and magnesium carbonates, and in turn, according to their alkaline reaction (pH 8.8), their use provides reclamation effect – eliminates the need for soil liming.

Harness, 90% caloricity unit (acetochlor) – soil contact herbicide. It is used to control annual cereals and dicotyledonous weeds before sowing, at the same time as sowing or before sprouting. Does not affect weeds that have already sprouted. Stability is shown by Sinapis arvensis, P. patulum, Melandrium album, Ambrosia artemisiifolia L. The protective effect lasts from six to eight weeks. Decomposes during one vegetational season. Can be used in a mixture with promethrin. With excessive soil moisture is phytotoxic to soybean plants. Application rate is 1.5-3.0 l/ha.

Basagran, 48% water solution (bentazone) – contact post-sprouting herbicide. It is used against annual dicotyledonous weeds (for best effect, leaves and stems should be well moistened with herbicide). Cold weather reduces the effect of the product. Spray crops in the phase of 2–3 soybean leaves at a temperature of +20ºC (after application of the product for at least 6 hours there should be no rain). Basagran works best in the early stages of weed growth. Application rate is 1.5-3.0 l/ha.

To determine the effect of complex fertilizer **Nitroamofoska-M** on soybean yield, the experiment was accompanied by the following calculations and laboratory studies:

- phenological observations of the soybean plants growth and development were carried out in accordance with the “Methods of State Crops Variety Testing” [1];
- sheaf samples were taken the day before harvest from a previously recorded area of 1 sq.m for plant density [2];
- structural analysis was performed by analyzing 25 plants taken from a sheaf sample [2];
- crop accounting was performed with the method of sub-threshing followed by grain cleaning and its conversion by 14% humidity [2];
- yield of pure harvested grain was converted to a standard 14% humidity, using the following formula

$$У = \frac{А(100 - в)}{100 - 14},$$

where: У – yield of pure grain at field humidity, t/ha; А – yield of pure grain at field humidity, t/ha; в – grain moisture at the time of harvest, %;

During the soybean vegetation season, the field experiments were accompanied by observations, records and laboratory studies according to the methods [1-4].

Predecessor – winter wheat. Plowing was carried out in mid-September with a plow PN - 3 - 35 in the unit with a tractor MTZ-80 to a depth of 28 cm.

In spring to close moisture cultivation with harrowing was carried out, using units T - 150K + 2KPS - 4 + 8 BZTS - 1,0. Re-harrow cultivation was used to kill weeds (white thread phase).

Pre-sowing tillage was carried out with the combiner LK - 4 to the depth of seed planting. Mineral fertilizers were applied for cultivation in the norms according to the experimental scheme.

Sown with a row spacing of 12.5 cm and a plant density of 550 thousand seeds / ha to a depth of 3 cm MTZ -80 Maple 4.5. Before sowing, inoculation was performed with the bacterial fertilizer Optimais (2.8 l/t). The sowing date was May 17.

The following herbicides were used to control weeds: Harness (before germination) at the rate of 2.5 l/ha and Basagran (after sprouting in the phase of 2-3 leaves of the crop) – 2.5 l/ha.

Harvesting was carried out in the phase of seeds complete ripeness. Desiccations was not carried out.

Examinations results

The Mentor soybean variety, entered in the Register of Plant Varieties of Ukraine in 2013, was used in the research. The experiment was carried out according to the following scheme: 1 – Without fertilizers (control); 2 – Phosphorite flour (5 c/ha); 3 – Nitroamofoska-M (2 c/ha); 4 - Nitroamofoska-M (3 c/ha); 5 – Nitroamofoska-M (4 c/ha); 6 – Nitroamofoska-M (5 c/ha).

The established experiment during the culture vegetation season was accompanied by accounting and laboratory analysis according to the following methods [1-4].

The obtained three-year research data showed that this fertilizer had a significant effect on the productivity elements of Mentor soybean variety (Table 1). It should be noted that the indicators of crop structure (number of seeds from one plant, weight of seeds from one plant, plant height, attachment of the lower bean) were the lowest in the control (without fertilizers). However, with the increase of fertilizer rates (according to the research scheme) these indicators increased significantly and were the highest with the application of Nitroamofoska-M at the rate of 4 c/ha.

Table 1. Indicators of the Mentor soybean yield structure depending on the fertilizer, average for 2017–2019
Source: own research

Fertilization, c/ha	Number of seeds per plant, pcs	Mass of seeds from one plant, g	Plant height, cm	attachment of the lower bean, cm
Without fertilizers (control)	37,6	5,9	67	9,7
Phosphorite flour (5 c/ha)	46,7	7,9	78	11,5
Nitroamofoska-M (2 c/ha)	47,1	7,2	74	9,5
Nitroamofoska-M (3 c/ha)	51,3	8,5	77	11,2
Nitroamofoska-M (4 c/ha)	53,4	9,4	82	11,3
Nitroamofoska-M (5 c/ha)	52,7	9,1	86	12,6

Similarly, as our research shows, in the Western Forest-Steppe zone the yield of Mentor soybeans variety under the influence of Nitroamofoska-M complex fertilizer changed significantly and over the years of research on different variants of the experiment ranged from 2.51 to 4.06 t/ha (table 2). The lowest yield was observed in the control (without fertilizers), where it was 2.51 t/ha, the maximum – in case of Nitroamofoska-M (4 c/ha) – 4.06 t/ha.

In our studies, we observed significant increase in yield of Mentor soybeans variety in case of Nitroammophoska-M (4 c/ha) – 1.55 t/ha, or 61.8%.

Table 2. Mentor soybean yield depending on the fertilizer, average for 2017–2019
Source: own research

Fertilization, c/ha	Yield, t/ha	Grain on fertilization	
		t/ha	%
Without fertilizers (control)	2,51	-	-
Phosphorite flour (5 c/ha)	3,49	0,98	39,0
Nitroamofoska-M (2 c/ha)	3,16	0,65	25,9
Nitroamofoska-M (3 c/ha)	3,74	1,23	49,0
Nitroamofoska-M (4 c/ha)	4,16	1,65	65,7
Nitroamofoska-M (5 c/ha)	4,06	1,55	61,8

The results of three-year studies showed that fertilizer had a strong effect on the intensity of initial seed growth compared to the control variant (without fertilization), as a result of which this indicator within the experiment was at the level of 64-84%. The highest laboratory germination was observed in case with fertilizer of 4 c/ha and 5 c/ha, the lowest – in case without fertilizer. On other cases of fertilization, this figure was 98% (Table 3).

Table 3. Indicators of Mentor soybean seeds viability depending on fertilizer, average for 2017-2019
Source: own research

Fertilization	Natural weight, g / l	Laboratory germination, %	Sprouting rate, days	Sprouting friendliness, %	Intensity of initial growth of seed sprouting, %
Without fertilizers (control)	662	95	1,9	31,5	45
Phosphorite flour (5 c/ha)	685	98	2,2	32,7	84
Nitroamofoska-M (2 c/ha)	672	98	2,3	32,7	78
Nitroamofoska-M (3 c/ha)	704	98	2,2	32,8	64
Nitroamofoska-M (4 c/ha)	723	100	2,3	33,6	69
Nitroamofoska-M (5 c/ha)	713	100	2,3	33,1	69

Thanks to the researches performed, we found a significant impact of fertilizer application rates on the dynamics of total and active number of tubers in Mentor soybean plants.

As a result of calculations, it was found that the first tubers began to form in the phase of the crop's third leaf. The maximum number of them, within the experiment, was noted in case of Nitroamofoska-M application at the amount of 4 c/ha: in the budding phase the total number and number of active tubers was 49.7 and 45.4 units / plant; in the phase of full flowering – 54.2 and 53.7 units / plant, and a gradual decline in the phase of complete ripeness to 28.1 and 14.7 units / plant (Table 4).

Table 4. Influence of fertilizer on the dynamics of the soybean plants tubers number, average for 2017–2019, pcs / plant
Source: own research

Fertilization	Growth and development phase		
	complete budding	full flowering	complete ripeness
Without fertilizers (control)	7,5/5,7*	10,9/10,1	5,8/2,5
Phosphorite flour (5 c/ha)	18,7/16,3	20,4/19,3	8,7/6,4
Nitroamofoska-M (2 c/ha)	16,7/12,8	24,2/17,8	11,1/6,9
Nitroamofoska-M (3 c/ha)	32,1/28,2	35,8/34,1	17,5/7,3
Nitroamofoska-M (4 c/ha)	49,7/45,4	54,2/53,7	28,1/14,7
Nitroamofoska-M (5 c/ha)	20,3/17,7	28,6/19,2	15,4/6,2

*Note. In the numerator the total number of tubers, pcs /plant,
in the denominator the number of active tubers, pcs /plan

Conclusions

Thus, based on the results obtained, we can conclude that in the Western Forest-Steppe use of complex mineral fertilizer Nitroamofoska-M at a rate of 4 c/ha on soybean crops affects the increase of grain and symbiotic productivity, as well as the seeds viability and germinability.

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INDICATORS OF GROWTH AND SEED PRODUCTIVITY OF PLANTS OF MILK THISTLE IN CONDITIONS OF THE RIGHT-BANK FOREST-STEPPE OF UKRAINE

Summary

The article presents the results of research on the influence of sowing dates, sowing method and depth of seed wrapping on the formation of biometric indicators of milk thistle plants in the conditions of the Right-Bank Forest-Steppe of Ukraine.

The research material was the soil of the experimental field - typical leached black soil, low humus, medium loamy on forest-like loams. The variety of milk thistle Boykivchanka was used as an object of the research. The research was conducted in the research field of the Training and Production Center "Podilia" of State Agrarian and Engineering University in Podilia during 2015-2017.

The results of the research showed that in the variants where sowing was carried out per 1 cm, the plants were short, even modest. They had a smaller habit. The highest plants were formed in the first sowing period of wide-row crops with seed wrapping by 2 and 3 cm, plant height reached 135.8-139.3 cm. The largest number of seeds in the basket were sowing variants in the first decade of April with a row spacing of 45 cm and a seed wrapping depth of 2 and 3 cm. This figure was 123.5 and 124.2 pieces per plant, ie with an excess of control by 22.4 and 21.7 pieces. The largest number of seeds from the plant 1316.2 pieces was noted on the variant of the first term (at the level of thermal regime of the soil 8-10 °C) sowing at a row spacing of 45 cm and a seed wrapping depth of 3 cm.

Studied shows that the yield of milk thistle fruits significantly depends on biometric indicators, such as: the number of seeds per plant (correlation coefficient r = 0.82), the number of seeds in the basket (correlation coefficient r = 0.89) and the height of plants r = 0.83).

Key words: row spacing, seeding rate, biometrics, seeds, milk thistle

Introduction

Ukraine has all the conditions for cultivating valuable medicinal plants and processing them into pharmaceuticals. However, the areas under medicinal plants remain very small and do not expand, primarily due to imperfect cultivation technologies. Among the agricultural measures that can regulate the optimal conditions for plant growth and development, the choice of sowing date and method, seeding rate, application of fertilizers and biologically active agents, etc. are important [1].

In connection with the above requirements, we have launched a research to study the influence of soil and climatic conditions on the biometric performance of milk thistle plants.

Individual productivity of plants is a resultant indicator that testifies to the effectiveness of the use of soil and climatic potential and the use of technological techniques to intensify the processes of growth and development of the plant organism. In this regard, the value of the absolute values of individual productivity, we can objectively choose the best variants for the interaction of technological methods of cultivation, which in soil and climatic conditions of the region can determine the yield of milk thistle in production crops [2].

Khomina V. and Sheludko L. claim that the biometric parameters of medicinal plants can be influenced by various factors: sowing dates, row spacing, seed wrapping depth, mineral and organic fertilizers, biologically active agents (plant growth regulators, biological products, micropreparations). Milk thistle is no exception, and the yield of fruits of this culture depends on the location of plants per unit area and biometric indicators [3, 4].

Studies of Ushkarenko V.O., Fedorchuk V.G., Filipova I.M., Kisnichan L.P., conducted in the steppe zone of Ukraine under irrigation, found that the level of yield of milk thistle by 39.2% depends on mineral fertilizers, 26.2% - on the sowing period, 5.3% - on the width of the rows, 3.3% - on the method of tillage, the remaining percentage is due to the interaction of factors [5].

A number of researches have been conducted to study the conditions for obtaining the largest seed yields needed to meet the needs of the pharmaceutical industry. This issue has been studied in great detail by research institutions of the Middle Volga region of the Russian Federation. Scientists have concluded that the most appropriate is a continuous row method of sowing (row spacing - 15 cm), and the seeding rate - about 7 seeds per running meter of row (0.5 million / ha). The seed yield was close to 1 t / ha. In one of the experiments, increasing the seeding rate to 0.75 and 1.00 million / ha increased the yield by 5.1-8.2% [6].

In the conditions of the Saratov Right Bank, a study of seeding rates influence, sowing

methods and doses of mineral fertilizers on the productivity of milk thistle was performed. The author argues that on the black soils of the Saratov Right Bank thistle should be sown with a row spacing of 30 cm and a seeding rate of 400 thousand sprouting seeds per 1 hectare, sowing should be carried out at an early date. The maximum productivity of plants was obtained by applying $N_{80}P_{40}K_{40}$ in combination with pre-sowing seed treatment with 0.05% boric acid solution [7].

In the forest-steppe zone of Ukraine thistle is grown on small areas, but recently with the change of weather and climatic conditions, this culture is becoming more widespread, so we conducted research to study the influence of soil and climatic conditions on the formation of biometric indicators of milk thistle plants.

Purpose, subject and research methods

The purpose of our scientific work is to study the influence of sowing dates, sowing method and depth of seed wrapping on the formation of biometric indicators of milk thistle plants in the conditions of the Right-Bank Forest-Steppe of Ukraine.

The research was conducted in the research field of the Training and Production Center "Podilia" of State Agrarian and Engineering University in Podilia during 2015-2017.

The soil of the experimental field is typical leached chernozem, low-humus, medium loamy on forest-like loams. The content of humus (according to Tiurin) in the soil layer 0-3 cm is 3.6-4.2%. The content of easily hydrolyzable nitrogen compounds (according to Cornfield) is 98-139 mg / kg (high), mobile phosphorus (according to Chirikov) 143-185 mg / kg (high) and exchangeable potassium (according to Chirikov) - 153-185 mg / kg of soil (high). The amount of absorbed bases ranges from 158-209 mg eq./kg. Hydrolytic acidity is 17-22 mg eq./kg, the degree of saturation of the bases - 90%.

The research was carried out according to the scheme of three-factor field experiment: sowing dates (factor A): 1st first decade of April, 2nd-1st - second decade of April, 3rd - third decade of April; row spacing (factor B): 15 cm (solid row method), 45 cm (wide row method), 60 cm (wide row method); seed wrapping depth (factor C): 2 centimeters, 3 centimeters; 4 centimeters. A variety of milk thistle Boykivchanka was sown.

Repetition in the experiment is fourfold, the placement of plots is systematic, the area of the accounting plot is 54 m^2, the size of the protective strips is 1.5 meters.

Accounting, analysis and observation were performed in accordance with generally accepted methods of G.L. Bondarenko, K.I. Yakovenko., V.F. Moiseichenko [8, 9]. Analysis of plant structure was performed using the method of A. Smiriaev, M. Gokhman [10].

Research results

The height of plants was the lowest in the continuous of row method of sowing during all three terms, it was in the range of 93.0–119.1 cm (Table 1).

As for the depth of seed wrapping, in the variants where sowing was carried out per 1 cm, the plants were short, even modest. They had a smaller habit. The highest plants were formed in the first term of sowing of wide-row crops with seed wrapping by 2 and 3 cm, the height of plants reached 135.8–139.3 cm.

Table 1. Biometric indicators of milk thistle plants depending on the sowing dates, methods of sowing and depth of seed wrapping (average for 2015-2017)

Source: own research, research field of the Training and Production Center "Podilia" of State Agrarian and Engineering University in Podilia

Sowing dates	Row spacing, cm	Seed wrapping depth, cm	Plant height, cm	Number of leaves on the plant, pcs	Number of baskets on the plant, pcs	Diameter of baskets, cm	Number of seeds in the basket, pcs.	Number of seeds from the plant, pcs
I decade of April	15	2	119,1	11,7	3,5	4,3	112,9	395,2
		3	107,5	10,4	3,7	4,6	107,5	396,7
		4	96,3	10,2	3,3	3,6	103,1	340,2
	45	2	136,8	19,3	9,9	5,4	123,5	1222,1
		3	139,3	19,2	10,6	5,6	124,2	1316,2
		4	103,5	12,9	8.6	4,7	100,1	900,6
	60	2	137,1	18,7	9,7	5,3	121,2	1175,5
		3	135,8	19,0	10,1	5,5	119,8	1209,4
		4	110,2	12,0	8,8	4,8	101,3	988,8
II decade of April	15	2 (к)	116,5	10,0	3,4	4,1	101,8	346,1
		3	115,9	10,4	3,6	4,2	101,8	366,2
		4	95,2	9,8	2,9	3,3	96,5	249,8
	45	2	122,0	14,0	9,2	5,1	115,9	1066,2
		3	120,3	14,9	9,3	5,2	116,4	1082,4
		4	100,0	13,9	8,3	4,8	111,1	888,7
	60	2	123,5	14,2	9,2	5,0	116,8	1074,4
		3	121,9	15,0	9,4	5,0	119,0	1118,5
		4	99,8	12,7	8,4	4,5	109,5	891,3

III decade of April	15	2	99,5	9,4	3,1	3,7	93,5	289,7
		3	100,1	9,2	3,0	3,9	96,2	288,6
		4	93,0	9,0	2,7	3,2	90,1	243,2
	45	2	112,5	12,5	8,4	4,9	105,6	887,0
		3	106,2	12,1	8,1	5,0	103,2	835,9
		4	98,5	11,0	7,0	4,2	100,2	502,0
	60	2	115,1	13,0	8,5	4,7	106,8	907,6
		3	114,9	12,7	8,3	4,8	107,6	893,0
		4	95,7	10,9	7,2	4,0	99,8	818,8

*Note: * (k) - control*

It should be noted that at a later sowing there was a tendency to form less tall plants.

Regarding the number of leaves on the plant, this figure varied depending on the time of sowing, row spacing and depth of seed wrapping. The largest number of leaves was formed on plants of the first sowing period with widths between rows 45 and 60 cm and depth of seed wrapping 2 and 3 cm, this figure was respectively: 19.2 and 19.3 pieces per plant, ie with an excess of control by 8.8- 8.9 pcs. The number of leaves also affects the leaf surface area and, as a consequence, the photosynthetic potential of the agrocenosis.

Since the medicinal raw materials of milk thistle are seeds, the indicators: the number of baskets, the diameter of the basket and the number of seeds from the basket are among the most important biometric indicators, which ultimately affect the yield of medicinal plant raw materials.

Thus, the largest number of seeds on average from the test sheaf plants were sowing variants in the first decade of April with a row spacing of 45 cm and a depth of seed wrapping of 2 and 3 cm. This figure was 123.5 and 124.2 pieces per plant, ie with excess control by 22.4 and 21.7 pcs.

Baskets with the smallest number of seeds were on the variants, which were sown in the third decade of April in a continuous way to a depth of seed wrapping of 4 cm, namely - 90.1 pieces, which is less than the control by 11.7 pieces.

The formation of less productive plants at later sowing dates is due to the lack of effective temperatures during the growing season.

It should be noted that empty baskets are formed during sowing with a row spacing of 45 and 60 cm, in which the seeds were not tied at the time of harvest, but their number was insignificant - an average of 2-3 pieces per plant, so they do not significantly affect the final yield small.

The number of baskets on the plant and their grain size determined the individual productivity of milk thistle plants. A significant difference in performance is observed depending

on the width of the rows. With the continuous row method of sowing, 3.2–4.6 baskets were formed on the plant, in which 243.2–396.7 seeds were tied and formed.

In our opinion, with wide-row sowing methods, the plants had a larger nutrition area, competed less with each other, were better lit, and therefore formed a larger number of productive shoots, and usually seeds in baskets.

Thus, the largest number of seeds from the plant 1316.2 pieces was observed in the variant of the first term (at the level of thermal regime of the soil 8–10°C) sowing at a row spacing of 45 cm and a seed wrapping depth of 3 cm.

Yield, as the main indicator of the assessment of all agronomic measures, in conjunction with the factors studied in our experiments, is shown on the basis of the constructed galaxy (Fig. 1).

Analysis of the relationship between plant productivity and the studied factors shows that the yield of milk thistle fruits significantly depends on biometric indicators, such as: the number of seeds per plant (correlation coefficient r = 0.82), the number of seeds in the basket (correlation coefficient r = 0.89) and plant height (correlation coefficient r = 0.83).

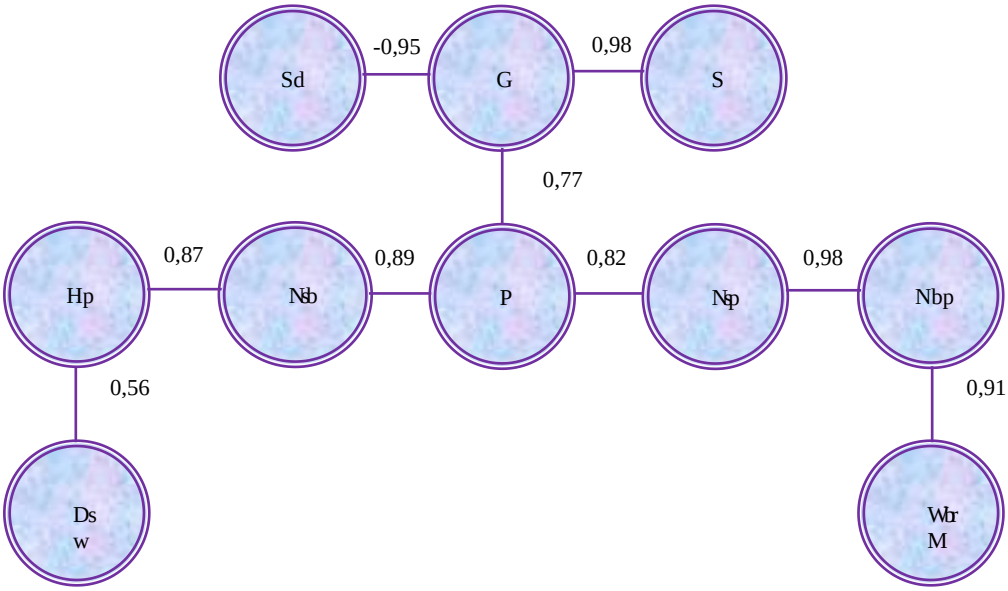

Fig. 1. Correlation galaxy of the system of indicators
Contents of variants: SD - sowing date; g - germination; s - survival; Dsw - depth of seed wrapping; Hp - height of plants; NSB - the number of seeds in the basket; P - productivity; NSP - the number of seeds per plant; NBP - the number of baskets on the plant; Wbr - width between rows
Source: own research, research field of the Training and Production Center "Podilia" of State Agrarian and Engineering University in Podilia

Thus, there is a strong correlation between yield and these indicators. The average

correlation was established between yield and stem density, so the correlation coefficient r = 0.77 was established between germination and yield and the correlation coefficient r = 0.72 - between survival and yield.

Conclusion

Therefore, based on research results, it can be concluded that weather conditions are favorable for growing milk thistle, and the best biometric indicators provided the sowing period in the first decade of April with a row spacing of 45 cm and seed wrapping depth of 3 cm. In this variant the greatest height of plants, number of leaves, baskets and accordingly more seeds from a plant - 1316,2 pieces that is 970,1 pieces more, than on control is noted.

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INFLUENCE OF ^{232}Th AND ^{90}Sr RADIONUCLIDES ON THE STATE OF NATURAL ANIMALS RESISTANCE IN RADIOACTIVELY CONTAMINATED TERRITORIES OF UKRAINE

Summary

The influence of ^{137}Cs and ^{90}Sr at different concentrations in rations on the functional state of natural resistance of cattle in radioactively contaminated territories of Ukraine was investigated. It was found that radioactive cesium and thorium had a negative effect on the functional state of the natural resistance of cattle. Against the background of the influence of small doses of ionizing radiation, changes were observed in the leukopoietic system, phagocytic activity of neutrophils, the bactericidal activity of blood serum, and T- and B-lymphocytes.

Key words: resistance, ionizing radiation, cesium-137, strontium-90, radiation pollution

Introduction

The overall feature of the current ecological state of Ukraine is that ecologically acute local moments are aggravated by the regional crisis. The Chernobyl disaster with its long-term biological impact has created a situation in the country that over the years is approaching the level of a global environmental catastrophe. More than 2 million people live in the territories classified as zones of radioactive contamination in 12 regions of Ukraine, agriculture and animal husbandry are actively developed [3].

A significant increase in the radioactivity of the natural environment becomes threatening due to the negative impact of radioactive radiation from radioisotopes in soil, water, and feed. This leads to genome instability, loss of the ability of cells to adequately respond to stimuli, regulate ontogenetic development, etc. [7].

The natural background radiation is determined by the presence of a large number of chemical elements scattered in the environment of radionuclides, as well as by cosmic radiation. For many years, this background radiation remained almost unchanged, and the radiation doses conditioned by it (about 1 mSv / year) did not cause a pronounced effect of radiation damage. However, in recent decades, the levels of ionizing radiation have increased due to the entry of additional sources of radiation into the biosphere: waste from nuclear power plants and nuclear industry enterprises, and most of all from radioactive releases after tests of atomic weapons and accidents at nuclear power plants, among which the most important is the accident at the Chernobyl nuclear power plant [5].

Long-term studies of scientists show that the radioecological factor (the general effect of an increased background of natural radiation by one to two orders of magnitude compared to background values and geochemical, climatic, and other natural and man-made conditions) can negatively affect the body and animal populations even at very low levels of ionizing radiation. On the example of the population of root voles, a high level of morphophysiological, histomorphological, cytogenetic variability of some organs and systems under the influence of an increased level of natural radiation in biogeocenoses was demonstrated [8].

In the study of cattle, in animals that have been under the influence of low-intensity ionizing radiation for a long time, blood counts are at the lower limit of the norm; over the course of a number of experiments, a "shift" of neutrophils to the left was observed. Animals brought to the zone of radioactive contamination being already adults are more stress-resistant than local animals, but over the years this difference almost disappears, and those raised in the “contaminated” zone are more painful. They were sick more often and longer with various forms of endometritis and mastitis [9]. At the same time, far from all the possible consequences of irradiation (under conditions simulating a nuclear reactor accident) have been studied so thoroughly as to become classical, that is, to be unambiguously perceived in the scientific environment. This is especially true of long-term exposure to radiation in the range of so-called "small doses", the boundaries of which are still not clearly delineated and do not have a generally accepted scientifically substantiated definition. Based on the realities prevailing in radiation-contaminated populated areas, the most unexplored range of doses is from near-background values to several tens of mSv / year, which will be conventionally called the range of low doses. It is concerning it that radiobiologists have no consensus in assessing the biological consequences of irradiation of mammals, on the contrary, sometimes diametrically opposite statements are made - from the statement of increased radiosensitivity [1] to the existence of a threshold below which negative radiobiological effects are not manifested and even biological stimulation occurs, i.e.

hormesis effects [4].

One of the main components of radioactive contamination of the biosphere is cesium-137 (radiocesium, 137Cs) – contained in radioactive fallout, radioactive waste, emissions from plants that process waste from nuclear power plants, is intensively sorbed by the soil and deposited in water [1]. Strontium-90, also known as radiostrontium, a radioactive nuclide, is produced primarily by the separation of nuclei in nuclear reactors and nuclear weapons. 90 Sr gets into the environment mainly during nuclear explosions and emissions at nuclear power plants. Considering this and the fact that strontium-90 has a relatively long half-life, it is preferably used as a marker in determining the boundaries and levels of anthropogenic radioactive contamination. At the same time, the total level of ionizing radiation, including γ- and α- and the total content of all polluting radionuclides, in particular short-lived ones, in a given area may be higher than those for strontium -90 or β-radiation [2].

Among the three main ways of radionuclides entering the human body (inhalation, alimentary, cutaneous), the alimentary way is of paramount importance. Since 1989, 95-98% of the internal radiation dose of people living in the contaminated area were formed due to cesium-134 and 76 cesium-137, 3-4% - due to strontium - 90, all other radionuclides were not more than 1 -2%; some of them further decreased due to disintegration [7]. Fortunately, the density of plutonium contamination of agricultural land outside the 30-kilometer zone is negligible (no more than 8.7 kBq / l). In addition, in the soil-plant system, plutonium compounds are inactive, absorption into the digestive tract is not more than 0.01-0.003%. Therefore, plutonium radionuclides do not pose a significant hazard as food contaminants. Thus, 30 years after the accident, the main dose-forming nuclides supplied with food are cesium-137 and strontium-90 [9]. At the same time, a number of authors investigated that radioactive cesium has a negative effect on the functional state of the natural resistance of cattle [6].

According to the Ministry of Ukraine for Emergencies and Protection of the Population from the Consequences of the Chernobyl Catastrophe in 2018, the content of ^{137}Cs and ^{90}Sr is the highest in the soils and water of Ukraine [10]. That is why the purpose of our research was to reveal the effect of low doses of ionizing radiation^{137}Cs and ^{90}Sr on the functional state of cattle resistance in Podillia region.

Research results

To achieve this goal, the following tasks were set: to determine the contamination of the territory, pastures, and rations with radionuclides in the farms of Podillia region, to study the

features of the functional state of the natural resistance of cattle in farms with different intensity of radioactive contamination.

Radiological, hematological, biochemical, immunological research methods were used in the research.

Clinical and experimental studies were carried out on cattle aged 4-8 years, live weight 350-450 kg, on the premises of family farms in Kamianets-Podilskyi and Chemerovtsi districts of Khmelnitskyi region. Three experimental groups of cattle were formed. The first group included livestock from settlements with a soil contamination level of ^{137}Cs and ^{90}Sr to 40 кБк/м^2, the second – animals from settlements with a pollution level from 40 to 100 kBq / m2, and the third - with a level of m2 contamination. The conditions for feeding, caring for, and keeping animals in all three farms were the same.

Laboratory radiological studies were carried out in the research laboratory of the Department of Normal and Pathological Physiology and Morphology of the Higher Education Institution "Podillia State University". The material for laboratory research was the soil, feed, and blood of cattle.

Blood for morphological, biochemical, immunological studies was taken from the jugular vein in experimental cows before feeding in accordance with the rules of asepsis and antiseptics.

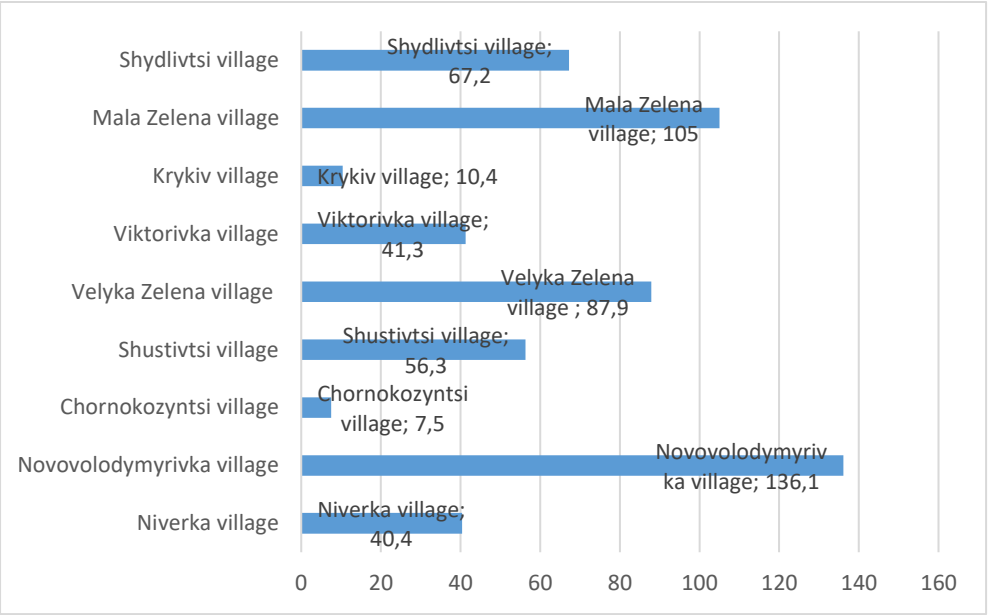
One experimental group was formed on each farm with 20 cows. All cows were examined for clinical status according to generally accepted methods. To assess the radiation situation and determine the intake of radionuclides into the animal organism, in each of the experimental farms, the gamma background was measured using SRP-68-01 at various livestock facilities and the specific radioactivity of the feeding fodder.

In experimental groups of cows, in laboratory conditions, the following was studied: the number of leukocytes and erythrocytes - by counting in the Goryaev's chamber, leukocyte formula - by counting white blood cells in smears stained according to Romanovsky-Giemsa; the absolute content of lymphocytes in the peripheral blood - by the calculation method; the content of total protein in the blood serum - using a refractometric, hemoglobin - by the generally accepted method using a Sali hemometer; bactericidal activity of blood serum - by photonephelometric method according to D.A.Petrachev; lysozyme activity of blood serum - by the photoelectrocolometric method in the modification of the department of zoo hygiene of the UNIIEV; opsonophagocytic activity of blood leukocytes - by the method of absorption by leukocytes St. Aureus 209-P followed by counting on a stained smear according to Romanovsky-Giemsa; T-lymphocytes - by the method of spontaneous rosette formation with sheep erythrocytes (E-ROK); B-lymphocytes - by the method of detecting on their surface receptors up to the Fc fragment of immunoglobulins

and C3 (EAK-ROK).

According to the research results (Fig. 1), most of the settlements had pollution from 40 to 100 kBq / m^2, but in two settlements the level of soil contamination with ^{137}Cs was significantly less than 40 kBq / m^2. It was found that animals in the summer period were grazed on pastures with contaminated grass stand with radionuclides, and in the winter stall period they were fed in the diet of feed also contaminated with radionuclides, the total contamination of the diet in the winter stall period was 3158, respectively.

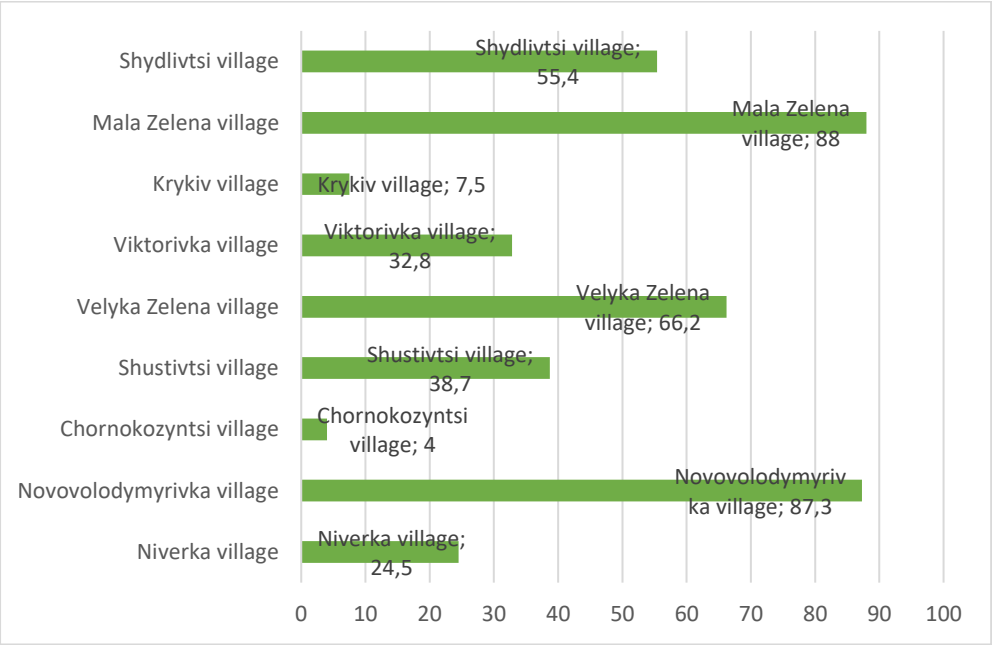
Fig. 1. Level of soil pollution ^{137}Cs (kBq / m^2) in the settlements of Western Podillia referred to the fourth zone of radioactive contamination
Source: https://www.dsns.gov.ua/UserFiles/File/2009/table_1.pdf



According to the results of studies of soil contamination with ^{90}Sr (Fig. 2), most settlements had pollution from 40 to 100 kBq / m2, however, in two settlements, the level of soil contamination with Sr was also significantly less than 40 kBq / m2. At the same time, the lowest level of soil contamination ^{90}Sr was observed in the villages of Krykiv and Chornokozyntsi, and the highest level is in the villages of Novovolodymyrivka and Mala Zelena. The obtained data can be explained by the fact that in the immediate vicinity of these settlements is the Khmelnytsky nuclear power plant, which makes adjustments to the overall analysis of its emissions.

The total contamination of the diet during the winter stall period was 2954 and 2036 Bq, respectively.

Fig. 2. Level of soil pollution ^{90}Sr (kBq / m^2) in the settlements of Western Podillia referred to as the fourth zone of radioactive contamination
Source: https://www.dsns.gov.ua/UserFiles/File/2009/table_1.pdf



In the experimental animals, the morphological parameters of the blood (Table 1) were within the physiological norm, but in the animals of the third group they were significantly lower compared to the animals of the first group, which were kept in farms with ^{137}Cs and ^{90}Sr contamination below 40 kBq / m^2. The leukogram showed significant changes in the blood of animals from farms with the high radioactive background.

Concerning erythrocytes, it should be noted that their content in the blood decreased depending on the contamination of ^{137}Cs and ^{90}Sr diets, but this difference is unlikely. Analyzing the leukoformula, it should be concluded that with increasing concentration of ^{137}Cs and ^{90}Sr in the diets of animals of the third group there is a decrease in the content of segmental neutrophils and monocytes ($p > 0.95$), with a probable increase in the content of rod neutrophils and lymphocytes in both indicators.

There was a decrease in the number of basophils, segmented neutrophils, lymphocytes, and monocytes in the blood of animals from the contaminated area in relation to their counterparts from the conditionally clean area, and there were fewer stab neutrophils only in animals, although these changes were not sufficiently pronounced. The content of ^{90}Sr influenced the leukoformula to a lesser extent. At the same time, the number of eosinophils, on the contrary, was probably higher in animals from the zone of radioactive control.

Table 1. Morphological parameters of cattle blood
Source: own survey based on conducted research

Radionuclide		^{137}Cs	^{90}Sr	^{137}Cs	^{90}Sr	^{137}Cs	^{90}Sr
Indexes		**I group**	**I group**	**II group**	**II group**	**III group**	**III group**
Erythrocytes, T / l		5,20±0,2	4,10±0,10	5,03±0,21	4,00±0,1	4,47±0,31	3,89±0,38
Leukocytes, G / l		9,17±0,3	8,10±0,24	7,67±0,4	5,22±0,3	6,70±0,46*	5,62±0,33*
Leukoformula, %:							
Basophils		0,1±0,04	0,2±0,01	0,03±0,02	0,01±0,01	0	0
Eosinophils		6,00±0,41	4,00±0,32	5,00±0,41	3,00±0,12	4,33±0,47	3,83±0,24
Neutrophils	Juvenile	0,2±0,08	0,1±0,04	0,33±0,06	0,33±0,06	0,7±0,08	0,74±0,01
	Band	3,3±0,62	2,3±0,48	4,00±0,41	3,00±0,31	5,67±0,24*	4,35±0,07*
	Segmented	23,00±0,8	19,00±0,2	20,67±0,4	10,20±0,2	18,00±0,1*	16,00±0,1*
Lymphocytes		61,70±0,8	54,70±0,4	65,9±0,6*	58,9±0,5*	68,97±0,6*	55,57±0,1*

Note. Here and beyond * – p>0,95.

According to the indicators of the cellular defense factor of the organism, a probable decrease (P> 0.95) in the phagocytic activity of neutrophils was observed in cows with a zone contaminated with radionuclides and a pronounced decrease in the phagocytic intensity of neutrophils (P> 0.95) compared with analogs from the clean zone.

Table 2. Immunological parameters of cattle blood
Source: own survey based on conducted research

Radionuclide	^{137}Cs	^{90}Sr	^{137}Cs	^{90}Sr	^{137}Cs	^{90}Sr
Indexes	**I group**	**I group**	**II group**	**II group**	**III group**	**III group**
BASK, %	55,00±2,04	54,00±1,0	51,67±2,49	50,12±3,19	48,00±1,67*	39,00±1,55*
LASK, %	27,33±1,25	22,53±1,13	30,33±1,63	24,38±1,22	36,67±2,05*	29,14±1,05*
Lymphocytes, G/l	6,47±0,37	5,49±0,55	4,30±0,45*	3,30±0,12*	3,77±0,42*	2,84±0,02*
T- lymphocytes, %	34,67±1,43	30,29±1,63	31,33±1,65	28,30±1,12	29,33±1,84*	28,40±1,19*
B-lymphocytes, %	16,33±1,70	14,50±1,90	13,67±1,03	10,22±1,0	12,50±1,14*	10,40±1,4*

After analyzing the changes in the immunological parameters of the blood of the

experimental animals (Table 2), it should be concluded that in the third experimental group there was a probable decrease in the bactericidal and lysozyme activity of blood serum, the content of lymphocytes and T- and B-lymphocytes (p> 0.95). While in animals of the second group, a decrease in these blood parameters was not likely, with the exception of the lymphocyte content.

According to the results of the study, it was found that radioactive cesium to a greater extent and thorium to a lesser extent caused a negative impact on the functional state of the natural resistance of cattle. The most sensitive were the leukopoietic system, phagocytic activity of neutrophils, bactericidal activity of serum and T- and B-lymphocytes. Blood indexes of cattle kept in the area of radioactive contamination were within the physiological norm.

However, a decrease in the number of leukocytes was observed, in the leukoformula the number of young and stab neutrophils and lymphocytes increased, the level of sigmentonuclear neutrophils and monocytes, bactericidal and lysozyme activity of blood serum, the content of B and T lymphocytes decreased.

Table 3. Biochemical parameters of cattle blood
Source: own survey based on conducted research

Radionuclide	**^{137}Cs**	**^{90}Sr**	**^{137}Cs**	**^{90}Sr**	**^{137}Cs**	**^{90}Sr**
Indexes	**I group**	**I group**	**II group**	**II group**	**III group**	**III group**
Hemoglobin, g / l	95,00±4,08	93,00±2,02	89,00±2,04	85,00±1,04	81,00±3,34*	78,00±3,08*
Total protein, g / l	69,00±1,87	68,00±0,81	65,00±2,04	62,08±1,08	62,00±2,16*	58,00±1,10*
Albumins, %	37,67±2,46	35,03±2,10	36,00±1,87	34,00±2,45	32,00±0,82	30,00±0,52
α-globulins, %	11,67±0,62	10,12±0,52	12,00±0,82	10,23±0,48	13,00±0,82	10,00±0,42
β-globulins, %	14,00±0,82	12,00±0,2	12,67±1,25	10,36±2,36	10,33±1,65	08,27±1,88
γ- globulins, %	36,67±2,62	34,27±2,30	39,33±1,84	36,75±1,00	44,67±3,47*	41,62±2,27*

Analyzing the changes in the biochemical parameters of the blood of experimental animals, it should be noted that the difference between the first and second experimental groups was not probable, although a decrease in the content of hemoglobin and total serum protein, albumin, and β-globulins was observed with an increase in the concentration of α- and γ-globulins.

Conclusion

1. Blood indicators of cattle kept in the zone of radioactive contamination were within the

physiological norm.

2. Against the background of the influence of small doses of ionizing radiation, a decrease in the number of leukocytes was observed, in the leukoformula the number of young and stab neutrophils and lymphocytes increased, the level of sigmentonuclear neutrophils and monocytes decreased.
3. With an increase in the concentration of α- and γ-globulins, a decrease in the content of hemoglobin and total protein of blood serum, albumins and β-globulins, a decrease in the bactericidal and lysozyme activity of blood serum, lymphocytes, and T- and B-lymphocytes were also observed.

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OPTIMIZATION OF THE LAND-USE REGIME FOR TERRITORIES AND OBJECTS OF THE NATURE RESERVE FUND OF LOCAL IMPORTANCE

Summary

It has been set up that the main problem of establishing and observing the land use regime for territories and objects of the natural reserve fund of local importance is the absence of land management documents on the formation of restrictions on the use of lands and other natural resources closely related to land and their state registration in the state land cadastre.
Key words: land-use regime, nature reserve fund, restriction of rights, restrictions on land use

Introduction

There are 7388 territories and objects of the nature reserve fund of local significance in Ukraine. Their total area is 1.5 million hectares. Due to the norms of the articles 26, 28,31, 34, 36, 38, 42 of Law of Ukraine "On the nature reserve fund of Ukraine" territories and objects of the nature reserve fund of local significance - botanical gardens, dendrological parks, zoological parks, parks-monuments of garden and park art, some reserves, natural monuments, nature reserves, regional landscape parks are not considered environmental institutions and ensuring the protection regime and their territories preservation is assigned to the owners or users of land plots within which these territories and objects are located. The determination of the regimes for the protection and preservation of territories and objects of the natural reserve fund is carried out in the form of protective obligations. In accordance with Article 8 of the abovementioned law, the preservation of territories and objects of the natural reserve fund is ensured by: the establishment of a reserve regime; organization of systematic observations of the state of protected natural

complexes and objects; conducting comprehensive research in order to develop a scientific basis for their conservation and effective use; compliance with the requirements for the protection of territories and objects of the natural reserve fund during the implementation of economic, management and other activities, the development of design and project planning documentation, land management, forest management, environmental expertise; introduction of economic levers to stimulate their protection; implementation of state and public control over the observance of the regime of their protection and use; establishment of increased responsibility for violation of the regime of their protection and use, as well as for the destruction and damage of protected natural complexes and objects; conducting broad international cooperation in this area; carrying out other activities in order to preserve territories and objects of the natural reserve fund. Due to article 14 of Law of Ukraine "On the nature reserve fund of Ukraine" regime of territories and objects of the nature reserve fund (NRF) is a set of scientifically substantiated ecological requirements, norms, and rules that determine the legal status, the purpose of these territories and objects, the nature of permissible activities in them, the order of protection, use and reproduction of their natural complexes.

Problem setting

The regime of territories and objects of the nature reserve fund is determined in accordance with the specified Law, taking into account their classification and purpose. In order to determine and substantiate production measures in accordance with the legislation and the requirements of international treaties of environmental, research, recreational, economic activities, protection, reproduction, and use of natural complexes and objects, which are supposed to be carried out within five years, as well as a strategy for the development of the object of the natural reserve fund for ten years, a project is being developed for organizing the territory of the object of the natural reserve fund. Such projects should establish restrictions on the use of land and other natural resources that are located on land plots and registered in the state land cadastre. At the same time, in more than 90% of the territories of the NRF, such restrictions did not pass state registration and were not communicated to the owners of land plots and land users. And according to article 111 of the Land Code of Ukraine, restrictions are in effect from the moment of state registration.

Aim of the article

Studying the problems of establishing and observing the regime of land use of territories

and objects of the natural reserve fund of local importance.

Research results

1. Restriction (encumbrance) of rights on NRF lands. Since the time of Roman law [1], restrictions on ownership of land have been known. Thus, the right of ownership of public roads was limited to the right of anyone to move on them, to move goods, to drive cattle. Landowners were required to build free firebreaks around buildings, allow neighbors, and collect fruit from trees growing in neighboring areas. The rules of Roman law on the restriction of land rights were reproduced in the Civil Code of Napoleon (1804), as well as in the Civil Code of the German Empire (1896) [2]. In the first part of Art. 110 of the Land Code, it is established that "the use of the land plot or its part may be subject to restrictions (encumbrances) on the rights of other persons in the amounts provided by law or contract [3]. Nosik V.V. believes that the restriction of ownership of a land plot is an independent type of land legal relationship arising based on legal facts determined by law or in an agreement in cases provided for by law. Restrictions relate to the subject of the right to land and are aimed at performing certain actions or abstaining from them in order to ensure the rights of third parties. In his opinion, encumbrances of land ownership rights relate to a land plot as an object of law, are established in order to ensure the interests of third parties in such a plot in the manner prescribed by law or contract, are combined with the rights of third parties to this complicating, complicating, prevents the owner from freely exercising their powers, imposes on the owner the burden of unnecessary obligations associated with the use of the land [4]. The restrictions established concerning a land plot are not associated with the person of the landowner or land user, but only determine the narrowing of the boundaries of his subjective right. This means that when the right to a land plot is transferred, the restrictions concerning it remain, and any person who acquires the right to this plot will have to perform this right, taking into account the established restrictions [3]. The right to a land plot for environmental protection may be limited by law or contract, in particular:

- by banning certain activities;
- bans on changing the purpose of land, landscape and appearance of real estate;
- conditions for compliance with environmental requirements or performance of certain works;
- conditions to grant the right to hunt, catch fish, harvest wild plants on their land at the prescribed time and in the prescribed manner.

Prohibitions on the implementation of certain types of activities arise from the legal regime

of security and sanitary protection zones, sanitary protection zones, and other territories with a special regime. Restrictions on compliance with environmental requirements or the performance of certain types of work do not apply to the conditions for compliance with the general provisions of environmental legislation that are binding on any subjects of land relations (Articles 91 and 96 of the Land Code). At the same time, the procedure for establishing additional restrictions by the environmental legislation of Ukraine is not defined. They are envisaged to carry out this in protective obligations on the territory and objects of the natural reserve fund, which are drawn up in accordance with Art. 28 Law of Ukraine “On the nature reserve fund” [5] and Art. 23 Law of Ukraine “On the protection of cultural heritage” [6].

2. Legal regime of lands of the nature reserve fund (NRF). According to Article 19 of the Land Code, the lands of Ukraine are divided into categories due to the main purpose and according to Article 18, the categories of lands of Ukraine have a special legal regime. The term “main purpose” concerning the differentiation of land resources of the country, their distribution by category, indicates the possibility of using several “primary” purposes or “primary” and “secondary”. As a synonym for the term "main purpose" in land management practice, the concepts of "functional purpose" and "functional use" are widely used, as well as the concepts defined in the Ukrainian classifier of the intended use of land, put into effect by the letter of the State Committee for Land Management of Ukraine dated 24.04.98, No. 14 -1-7 / 1205. This document is not properly approved and registered with the Ministry of Justice, is not promulgated in the prescribed manner under the provisions of Articles 57 and 117 of the Constitution of Ukraine, is not valid but was widely used in the registration of legal documents for land. The distribution of land by category is constantly changing in the latest editions of the Land Code of Ukraine, which confirms the widespread belief in scientific circles about the need to revise this classification. So, not according to the criterion of intended purpose, they refer to the lands of transport and lands of land defense, which are used by the relevant state institutions. According to the criterion of territorial distribution, the category of land for housing and public buildings was determined. According to Art. 43 of the Land Code of Ukraine, the lands of the NRF include areas of land and water space with natural complexes and objects of special nature conservation, ecological, scientific, aesthetic, recreational, and other value, which, in accordance with the law, are given the status of territories and objects of the natural reserve fund. The assignment to the lands of the NRF is carried out according to a formal criterion - the provision of appropriate official status, and not the value of areas of water space and land, their nature conservation, ecological, scientific, aesthetic, and recreational status. Note that the lands of the NRF can simultaneously contain lands of historical and cultural significance (Art. 6 of the Law of Ukraine

“On the NRF of Ukraine”), forestry purposes (Art. 70, 85, 100 of the Forest Code of Ukraine), water resources (Art. 5, 8, 9, 94 of the Water Code of Ukraine). This is one of the examples of shortcomings in the classification of lands, their division into categories (Articles 18, 19 of the Land Code) according to the main purpose. Depending on the origin, other features of natural complexes and objects declared nature reserves or monuments, the purpose, and mode of protection reserves are divided into the landscape, forest, botanical, general zoological, ornithological, entomological, ichthyological, hydrological, general geological, paleontological and karst and speleological. Natural monuments are divided into complex, botanical, zoological, hydrological, and geological. In the category of lands of the NPF are also “lands of other environmental purposes” according to Part 1 of Art. 46 of the Law of Ukraine “On Nature Reserve Fund of Ukraine” to lands of other nature protection purposes include land plots, within which there are natural objects of special scientific value. This value is too general, not specific, and does not allow to determine which land plots can be classified as "lands of other nature conservation purposes". In our opinion, only valuable natural territories, as well as wetlands of international importance and for which the appropriate regime of use and protection has been determined in accordance with the resolution of the Cabinet of Ministers Ukraine of 23.11.1995 No. 935 “On measures for the protection of wetlands of international importance”. In 2002, the Ministry of Natural Resources of Ukraine approved the structure, content, and procedure for maintaining a passport for a wetland of international importance. The existing mechanisms for reserving valuable natural areas, as well as the definition of wetland areas of international importance, in Section VII of the Law “On the Natural Reserve Fund of Ukraine”, as well as the mechanisms (procedure) for the creation and declaration of territories and objects of the natural reserve fund, are imperfect, contradict the requirements of Art. 3 and 4 of chapter 14 “The right of ownership of land”, chapter 15 “The right to use land" and chapter 16 “The right to land easement” of the Land Code of Ukraine, as well as Ch. 32 “The right to use other people's property of the Civil Code of Ukraine”. In the modern period, only about 10 percent of the territories of the nature reserve fund have boundaries established on the ground. Restrictions and encumbrances in the use of land resources are determined and registered in the state land cadastre in less than 1% of specific territories of the nature reserve fund. Most of the lands of the territories and objects of the natural reserve fund of local significance are not confiscated from land users and landowners. Part five of the art. 12 of the Law of Ukraine “On the Natural Reserve Fund of Ukraine” provides that the management of territories and objects of the natural reserve fund, for which no special administrations are created, is carried out by enterprises, institutions, and organizations that are in charge of these territories and objects. By the Law "On the Natural Reserve Fund" (Articles 26,

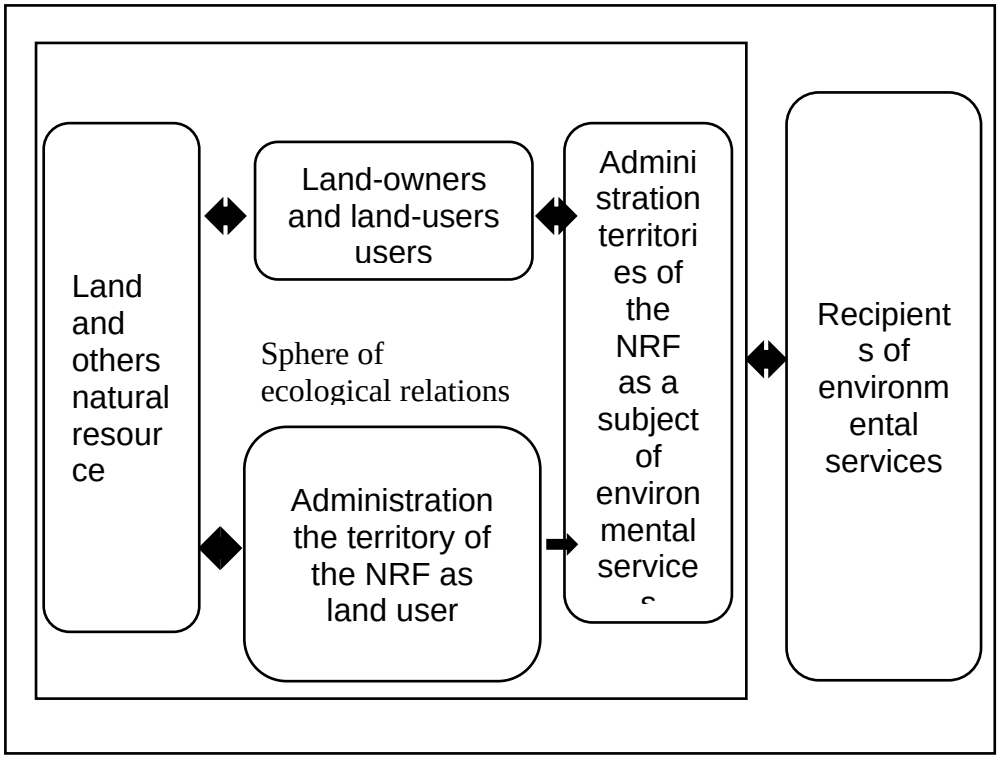
28, 30, 38), the owners or users of land plots, water, and other natural objects declared reserves, natural monuments, nature reserves, parks-monuments of gardening, and park art should take on themselves obligations to ensure the regime of their protection and safety with the registration of security obligations.

In 2013, the Instruction on registration of protection obligations on the territory and objects of the nature reserve fund was approved [8]. This instruction extended the practice of administering the territories of the natural reserve fund of local importance for which the Ministry of Natural Resources does not create special administrations. The determination of the regimes for the protection and preservation of territories and objects of the natural reserve fund of local importance is carried out in the form of protective obligations. This form is inherited from the time of the existence of an exclusive state form of ownership of land and other natural resources, as well as the dominance of socio-economic relations other than market ones. Requirements for land users for the protection and preservation of territories and objects of the natural reserve fund of local importance are formalized in the form of protective obligations, which are prepared by specially authorized environmental authorities. The same bodies also register protective obligations and send them out with an accompanying registered letter and notification of delivery to the subjects of the right to land, on whose lands protected areas are declared. As evidenced by many years of practice, such legal relations are formal, they only imitate active environmental protection, harming both the public interests and the interests of local residents and territorial communities. Along with this, the stable development of environmental activities, in particular, the network of territories and objects of nature reserves of local importance in combination with solving problems of cultural landscapes in rural areas in modern conditions creates priority conditions for the resource potential of the country's regions. rural (green tourism). The regime of protection and preservation and reproduction of natural complexes or their individual components for specific territories and objects of the natural reserve fund is not registered as a system of restrictions (encumbrances) in the state land cadastre in accordance with part five of Art. 7 of the Law of Ukraine “On the Natural Reserve Fund of Ukraine”. Any territory of a nature reserve fund has not been transferred for permanent use to a special administration for its management, in accordance with the norms of civil and land legislation, it should be considered as a restriction of rights. Restrictions on the use of land (except for restrictions directly established by law and adopted in accordance with regulatory legal acts) are subject to state registration in the State Land Cadastre in the manner prescribed by law and are valid from the moment of registration (Art. 111,112 of the Land Code of Ukraine). Information on the restriction in the use of land registered in the State Land Cadastre is justified in land management projects for the allotment of land plots,

in the technical documentation on land management for the establishment (restoration) of the boundaries of a land plot, in cadastral plans of land plots, in other documentation on land management, which is approved in one form or another. Encumbrances of rights to land plots (except encumbrances directly established by law) are subject to state registration in the State Register of Rights to Real Estate in the manner prescribed by the Law. The question is how the restrictions on the use of land directly established by law and the regulatory legal acts adopted in accordance with them are communicated to landowners and land users if they are not subject to state registration in the State Land Cadastre. According to the Instruction on the registration of protective obligations on the territory and objects of the natural reserve fund [8], the key place in the protective obligation is assigned to the list of obligations imposed on the land user (landowner) to ensure their protection and preservation of the corresponding territories and objects of the natural reserve fund. In our opinion, the obligations listed in clause 3 of the Appendix to the Instruction cannot be binding on specific subjects of the right to land, since they are only declared and not specified for the natural conditions of the respective territories and objects of the natural reserve fund, they are not registered as a system of restrictions (encumbrances) in the state land registry and do not come to the state registration. A protective obligation is essentially a unilateral agreement, according to which the landowner or land user (the first party) must assume obligations to the second party (the authorized authority) to perform certain actions or refrain from them, and the second party is the authorized executive authority, the power vested only with the right to demand, without the emergence of counter-obligations concerning the first party. Modern security obligations do not contain specific conditions agreed by the parties. Thus, the declared obligations are "to comply with the established regime for the territory of the object of the natural reserve fund; not to carry out prohibited economic activities; take measures to prevent and eliminate the environmental consequences of accidents and harmful effects; to ensure the protection and preservation of valuable natural complexes ". For specific territories of the natural reserve fund of local importance, depending on their origin, the landscape structure is inherent only in each of the specific conservation objects, for which an appropriate protection regime should be established. The form and content of the security obligation contradict the norms of civil and land legislation. In our opinion, the relations of authorized authorities with specific subjects of the right to land should be built on a contractual basis by concluding bilateral agreements. At the same time, the essential terms of the contract should be determined at the discretion of the parties and agreed by them and be mandatory for these parties. The contract must also contain conditions that are mandatory in accordance with acts of civil law. In contracts for the protection and preservation of the territory of a nature reserve fund of local significance, it is necessary to determine the terms

of their validity, the conditions for entry into force, the circumstances of the change in rights and obligations, the grounds for the change or termination of obligations. Fulfillment of the obligations of the subjects of the right to land to ensure the environmental regime and preserve valuable natural complexes that take place in the protected area determines the restriction of the right of the land user (landowner) to carry out effective profitable economic activity, reduces the cost of the land plot, necessitates spending funds to prevent harmful external influences to the territory (object) of the natural reserve fund and its protection. In this regard, a bilateral agreement should provide for the financial conditions for its implementation. After all, the essence of the economic and environmental relations of environmental land use has changed in a market economy and it can be formulated as the efficiency of organizing a set of relevant types of social life carried out in a specific territory with the involvement of the land and factor of other natural resources closely related to land or in another form and on the appropriate rights, at different scales and with different functional content in the process of economic, environmental and recreational relations of land use entities (Fig. 1).

Fig. 1. Model of the essence of economic and ecological relations of nature protection land use
Source: made by the author



Conclusion

1. The mechanism for formalizing security obligations on the territory and objects of the natural reserve fund introduced by order of the Ministry of Natural Resources dated February 25, 2013 No. 65 does not agree with modern market socio-economic relations, contradicts the norms of civil and land legislation.
2. The relations of the authorized environmental authorities with the subjects of the right to land, where the territories and objects of the NRF of local importance are located to ensure the regime of their protection and the preservation of valuable natural complexes, should be determined by legislative and regulatory acts through the official establishment in the process of land management and state registration in the state land cadastre of territorial environmental restrictions (encumbrances) in the use of land and other natural resources closely related to land, as well as specified in bilateral agreements in accordance with the norms of civil legislation.

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CREATING AN EDUCATIONAL ENVIRONMENT IN THE TRAINING OF PROFESSIONALLY MOBILE AGRICULTURAL ENGINEER

Summary

The article substantiates the need for training of professionally mobile agricultural engineers and reveals different approaches to the interpretation of the definition of "professional mobility of agricultural engineers", "educational environment". The signs of professional mobility of a specialist are specified in order to determine the criteria for choosing elements of the educational environment in the training of professionally mobile agricultural engineers. A three-stage method of designing an educational environment is proposed.

Key words: interdisciplinary relations, professional training, agricultural engineer, professional mobility

Introduction

Training of competent, mobile, competitive specialists is a priority for society, taking into account the following three drivers of scientific and technological progress and social development: education, industry and science. Society's need for professionally mobile specialists is mainly due to such global trends as modernization and restructuring of industries with automation of production processes, technologies and tools. Currently in demand are highly specialized workers who are able to solve complex professional problems based on knowledge, skills and experience in various fields of science and life.

Purpose, subject and methods of research

To specify the essence of the concepts "professional mobility of agricultural engineers", "information environment"; to design an educational environment that will promote the training of professionally mobile agricultural engineers and justify the functions of interdisciplinary links used in this process.

Research results

The reports of the European Commission state that the key to building European educational and scientific space is mobility. For Ukraine, as a participant in the Bologna Process, such tasks include the transformation of the education system at all levels with a focus on mobile personality training.

According to research by Focus magazine, in the ranking of "Top 20 most promising professions of the next decade" the profession of "agroengineer" ranks sixth, which will help increase its prestige and rapid promotion in the future, which will increase competition and competency requirements. mobility and professional qualities of the specialist [4]:

Domestic vocational education institutions, preparing agricultural engineers for the next decade, must work ahead, i.e take into account not only the changes taking place in the agricultural sector, but the factors that cause these changes. Prospects for the development of agro-industrial production are focused on the automation of processes and operations that help increase productivity, reduce labor costs and funds, increase the volume of environmental products to meet demand. Therefore, professional training should be accompanied by theoretical and experimental scientific activities of students.

The definition of "mobile", according to the interpretation in the dictionary, means capable of rapid movement; agile. [3]; "Mobility" - agility, the ability to quickly navigate the situation, to find the right forms of activity [2].

Professional mobility is a characteristic of the individual, determined by events that change the environment, the result of which is the self-realization of man in the profession and life, as well as the transformation of man himself and the environment [1].

Taking into account the opinions of scientists (Artyukhina O., Meng T., NovikovV., Horvat D., Bondar O., Krasnoshchok I., Romanovsky V., Bykov V., Kukharenko V., Sirotinko N., Rybalko O., Luzan P.) educational environment of vocational education institution is a set of conditions and resources that in cooperation provide opportunities for the most

productive process of training future professionals, as well as their cultural and personal development.

Designing educational space - creative research work, which includes 3 stages:

I. Search and selection of elements of educational space on the basis of the latest scientific research, current needs of society, forecast of directions of development of the industry to which the specialty of the applicant belongs.

II. Scientific substantiation of expediency of application of certain elements of educational space in the process of professional training of future specialists and conducting a pedagogical experiment to determine the effectiveness of the formation of professional mobility.

III. Spreading the experiment to a larger sample, taking into account the peculiarities of the functioning of those educational institutions in which it is conducted.

Criteria for selecting elements of the educational environment for the training of professionally mobile agricultural engineers, we have chosen the features that characterize the concept of "professional mobility". To determine these criteria (features), we analyzed the opinions of researchers on the nature of occupational mobility and identified its main features.

Table. 1. Signs of professional mobility of the specialist
Source: own study

Scientific position	Authors	Key features of professional mobility
As a form of social mobility	Zeyer E., Dementieva O., Lesokhina L, Rybnikov L.	Social activity, competitiveness, professional competence, ability to self-realization, self-development and modernization of own activity.
Integrative quality of personality	Timchenko O., Sushentseva L.	Perception of change, openness to the new, willingness to overcome external and internal obstacles, orientation in the professional space, adaptation, inclination to creativity, constant self-improvement and self-actualization, ability to take risks, take initiative, entrepreneurship in society, workplace.
Ability to self-development	Klimenko Y., Dyachenko A, Zeyer E., Kandybovich L.	Stable values, inner self-improvement, the need for self-development
Psychological readiness	Kovaleva V., Tikhonovich V., Shabonova M., Levchenko L., Shevchenko L., Muradyan N., Gaisin F., Faizov F.	Psychological flexibility, creativity, competitiveness,

There is a common position for all scientists: professional mobility is a form of adaptation of specialists to new technological and economic conditions of operation, which is formed under the influence of interdisciplinary and intersectoral ties in the process professional training and activities.

We define the professional mobility of agricultural engineers as their ability to quickly and efficiently implement professional and personal competencies (basic competencies, creativity, motivation for self-improvement and self-actualization) in professional activities (successful mastery and improvement of equipment and technologies, forms, methods and methods of production). to rapidly changing socio-economic, environmental and production conditions for the purpose of comprehensive self-realization of the individual.

Professional mobility of an agricultural engineer is characterized by his ability to:

• Use information and communication technologies in professional activities.

• Independently acquire knowledge and skills to perform non-standard professional tasks.

• Design trajectories for self-development and professional self-improvement.

• Fluent in at least one foreign language (at the conversational level) for international cooperation.

• To activate professional potential and personal qualities for operative performance of production tasks.

• Adapt to changing socio-economic and production conditions.

This characteristic of a professionally mobile specialist will help us to design an educational environment that will provide optimal conditions for self-realization of the individual, the disclosure of all potential resources, abilities, qualities embedded in it.

Conclusion

The objective problem of training a professional mobile agricultural engineer in the process of his professional training in vocational education institutions is the need for technological adaptation of this process in accordance with the requirements of the credit transfer system and transforming pedagogical activities in terms of combining training and research activities of future agricultural engineers.

Prospects for further research are to determine the components of the educational environment for the training of professionally mobile agricultural engineers on an interdisciplinary approach in education and industry.

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COMPETENCE OF THE RESEARCHER IN THE DETERMINED YIELDS OF WHITE CABBAGE DEPENDING ON THE INFLUENCE OF CULTIVATION TECHNOLOGY ELEMENTS IN THE CONDITIONS OF THE RIGHT-BANK FOREST-STEPPE OF UKRAINE

Summary

The article presents the results of research on the influence of cultivation technology elements, namely: drip irrigation, nutrition background and variety on the yield of late varieties of white cabbage in the Right-Bank Forest-Steppe of Ukraine.

Phenological observations, biometric and physiological-biochemical studies were performed according to the methods of G.L. Bondarenko, K.I. Yakovenko. The research was conducted during 2017-2019 in the experimental field of the Training and Production Center "Podilia" of State Agrarian and Engineering University in Podilia. The soil of the field is typical slightly leached chernozem.

The results of research have shown the effect of drip irrigation and mineral fertilizers on the yield of white cabbage late varieties. The most productive varieties of white cabbage have been identified, they are «Kharkivska zymova» and «Ukrayinska osin». The optimal calculated rate of mineral fertilizers $N_{120}P_{80}K_{150}$ was established and high efficiency of drip irrigation was obtained, yield increase is 61.9%. Also, studies have shown that the application of mineral fertilizers at the rate of $N_{120}P_{80}K_{150}$ contributed to the increase of NPP (net productivity of photosynthesis) in varieties of «Yana» to 3.35, «Kharkivska zymova» to 3.26 and «Ukrayinska osin» to 3.19 g / m^2 · day. It is established that drip irrigation makes it possible to reduce significantly the cost of irrigation water, to ensure its normalized supply directly to the area of the root system and to create optimal conditions for growth and development of cabbage.

Key words: late-ripening varieties of white cabbage, drip irrigation, mineral fertilizers

Introduction

Intensive technology of growing white cabbage is based on the use of domestic high-yielding late-ripening varieties, the use of mineral fertilizers for the planned harvest and drip irrigation by phases of plant growth and development.

Among the vegetable crops grown in Ukraine, white cabbage is the most common and consumed. It occupies the largest area among all vegetable plants in our country, it is grown on an area of about 76.3 thousand hectares [9].

Obtaining high and stable yields of cabbage in the region limits the deficit of nutrient reserves (chernozems typical of the land score are able to ensure a yield of white cabbage at 29.9 - 37.1 t / ha, depending on the content of nutrients). According to the average long-term reserves of moisture formed during the growing season in the soil, the average yield of white cabbage can be 43.4 t / ha (with fluctuations from 17.6 to 80.1 t / ha). In order to have a stable yield of late-ripening white cabbage at the level of 70 t / ha, the farm should grow 2-3 varieties, which in terms of biological features best meet the conditions of the region, and accordingly regulate the nutrient and water regimes of the soil [1, 2, 3, 9].

Thus, successful implementation requires more detailed development and application of adaptive energy-saving elements of technology (varieties, fertilizer doses and humidification regimes for growing white cabbage), improvement of growing methods of this important vegetable crop in changing conditions of the Right Bank Forest-Steppe of Ukraine. This will allow us to realize fully the potential of modern high-yielding late-ripening varieties of cabbage.

Purpose, subject and methods of research

The purpose of the research is to study the influence of drip irrigation, mineral fertilizers on growth, yield of late-ripening varieties of white cabbage in the conditions of the Right-Bank Forest-Steppe of Ukraine.

Research to study the impact of cultivation technology elements on the yield of late varieties of white cabbage were conducted during 2017-2019 in the research field of the Training and Production Center "Podilia" of State Agrarian and Engineering University in Podilia.

An important factor in the methodology of research in today's conditions is the ability of the researcher to use the methods of research competence and scientific achievements of scientists in this field in other countries. An example of this is the activity of scientists of the Higher School of Agribusiness in Lomza.

The soil of the field is typical slightly leached chernozem. Three-factor field experiment to study the elements of intensive technology for growing late white cabbage was carried out according to the scheme:

Factor A - regulation of water regime through the use of drip irrigation:

1. Control - without watering.

2. Drip irrigation.

Factor B - nutrition background:

1. Control - without fertilizers.

2. Application of mineral fertilizers in the dose of $N_{120}P_{80}K_{150}$ - in spring for cultivation (the rate of mineral fertilizers, which is determined to obtain the yield of white cabbage at the level of 70 t / ha).

3. Application of mineral fertilizers in the dose of $N_{60}P_{40}K_{75}$ - in spring for cultivation.

Factor C - varieties of late cabbage:

1. «Yana» - control.

2. «Kharkivska zymova».

3. «Ukrayinska osin».

The area of the elementary sowing plot is 39.2 m^2 (2.8 x 14 m), the accounting area is 28 m^2 (2.8 x 10 m), the repetition is four times. The experiment was based on the method of split sites. The water regime was studied in two separate blocks. Nutrition backgrounds and varieties of white cabbage were placed perpendicular to each other; split areas of varieties were within the variants of nutrition backgrounds.

Accounting and observations in the experiment were performed according to generally accepted methods [4, 6].

The technology of white cabbage growing, with the exception of the studied elements, was generally accepted for the region.

Seedling planting scheme is 70x50 cm, 28.6 thousand plants / ha.

During the growing season, two or three inter-row loosening of the soil was carried out. The optimal state of soil moisture (90-80% HB) was maintained by drip irrigation. Integrated protection of cabbage from pests and diseases was carried out taking into account the thresholds of their harmfulness to plants. Harvest was collected and accounted for manually [7].

To specify the essence of the concepts "professional mobility of agricultural engineers", "information environment"; to design an educational environment that will promote the training of professionally mobile agricultural engineers and justify the functions of interdisciplinary links used in this process.

Research results

Under the conditions of drip irrigation, the maintenance of optimal soil moisture is carried out directly after the phases of growth and development of white cabbage plants. Irrigation rate was determined on the basis of soil moisture control in the layer of 0-20 cm with the task to maintain it in the range from 90 to 80% HB.

During the growing season of cabbage, 16-19 watering's were carried out with water consumption from 880-1280 m^3 / ha (from 88 to 128 mm). Under optimal conditions of soil moisture and the rate of mineral fertilizers for the programmed yield, at the time of harvest in the experiment there was a significantly better survival of plants of late white cabbage, compared with the control.

The average plant density in the experiment ranged from 23.2 ± 0.42 to 26.5 ± 0.80 thousand / ha, which was from 81 to 92% of the theoretically possible (28.6 thousand / ha, plant nutrition area 0, 35 m^2 - 0.7x0.5 m).

Depending on the variant of the experiment, the number of leaves per plant varied as follows. When planting seedlings (3-5 true leaves), the weight of the aboveground part begins to exceed the weight of the root system, and with the advent of 10-12 leaves of the rosette, their weight is 100 times or more than the weight of the roots.

Late-ripening varieties of white cabbage by seedling cultivation technology begin to grow actively in 25-40 days after planting in the ground. At this time in the rosette of cabbage is formed from 13 to 19 leaves, and the area of their leaf surface, depending on the variety and cultivation technology reaches from 1.5 to 3.0 m^2. After 50-60 days of vegetation, the leaf surface area of cabbage reaches a maximum - 40-60 thousand m^2 / ha.

The main indicator of plant growth is the accumulation of dry matter during the growing season. Among the studied varieties of late-ripening white cabbage, its content was: in «Yana» - from 8.5 to 9.6%, in «Kharkivska zymova» from 8.2 to 9.0 and in «Ukrayinska osin» - from 8.0 to 8.9%.

The influence of the studied cultivation technology elements of late white cabbage on the collection of dry matter is most objectively evidenced by the net productivity of photosynthesis, the factor of which is the formation per day of dry matter in an area of one square meter.

According to research variants, the average net productivity of photosynthesis (NPP) during the growing season ranged from 2.51 to 4.12 g / m^2 day (Fig. 1).

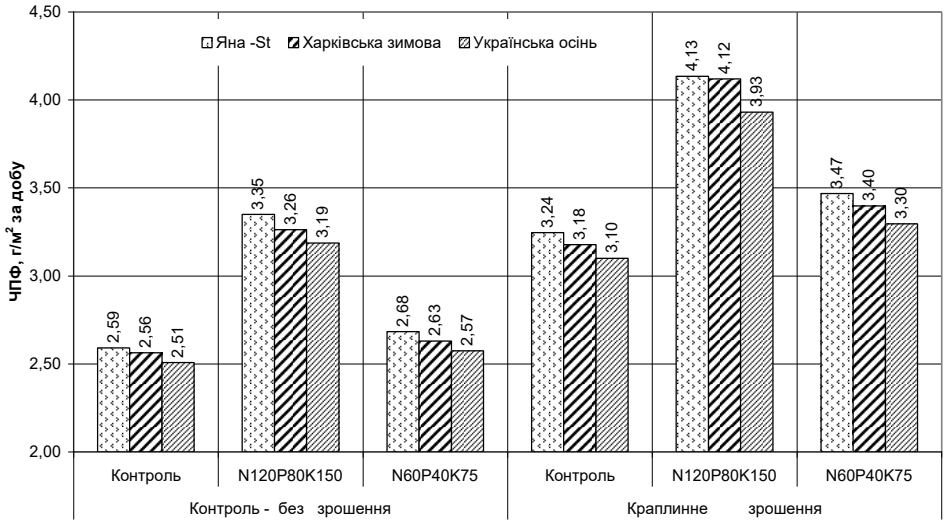

Fig. 1. ***Net productivity of photosynthesis of white cabbage varieties depending on irrigation and nutrition background (average for vegetation periods 2017-2019)***
Source: own research, research field of the Training and Production Center "Podilia" of State Agrarian and Engineering University in Podilia

In the control without irrigation and without fertilizers NPP of varieties of white cabbage was in the range of 2.51-2.59 g / m^2 day. Application of mineral fertilizers at the rate of $N_{120}P_{80}K_{150}$ contributed to the increase of NPP in «Yana» varieties to 3.35, «Kharkivska zymova» to 3.26 and «Ukrayinska osin» to 3.19 g / m^2 per day, and half the rate of $N_{60}P_{40}K_{75}$ - to 2.68, 2.63 and 2.57 g / m^2 per day.

In the variant of drip irrigation NPP of cabbage varieties was almost the same as in the preferred variant of mineral fertilizers - in the range of 3.24-3.10 g / m^2 day. The combined use of drip irrigation and mineral fertilizers with the norms $N_{120}P_{80}K_{150}$ and $N_{60}P_{40}K_{75}$ contributed to the increase of NPP of varieties compared to the control without fertilizers by an average of 60 and 48%, and with drip irrigation - respectively 23 and 13%.

Under optimal conditions for providing plants with moisture and nutrients, all varieties of late-ripening white cabbage in terms of yield exceeded the programmed level - 70 t / ha (Table 1).

Table. 1. The influence of drip irrigation and nutrition backgrounds on the yield of varieties of white late-ripening cabbage, t / ha (average for 2017-2019)
Source: own research, research field of the Training and Production Center "Podilia" of State Agrarian and Engineering University in Podilia

Drip irrigation, factor A	Nutrition background factor B	Variety, factor C			Average factor B	Difference	Average factor A	Difference
		Yana– St.	Kharkivska zymova	Ukrayinska osin				
Control - without irrigation	control	43,2	44,4	45,3	44,3	St	49,3	St
	$N_{120}P_{80}K_{150}$	55,4	56,3	57,6	56,5	12,2		
	$N_{60}P_{40}K_{75}$	46,0	47,1	47,9	47,0	2,7		
Drip irrigation	control	57,5	59,7	58,0	58,4	St	67,0	17,7
	$N_{120}P_{80}K_{150}$	74,9	78,2	76,1	76,4	18,0		
	$N_{60}P_{40}K_{75}$	65,0	67,5	65,8	66,1	7,7		
Average factor C		57,0	58,9	58,4				
Difference		St	1,88	1,45				
LSD_{05} = total 2.6; drip irrigation 0.9; nutrition background and varieties 1.1								

Compared to the «Yana» variety, «Kharkivska zymova» and «Ukrayinska osin» stood out among the late-ripening varieties of white cabbage both on the background without irrigation and with drip irrigation. In the variants without irrigation, «Ukrayinska osin» variety was the best, and with drip irrigation – «Kharkivska zymova».

According to the analysis of variance, the largest contribution to the increase in yield was observed from drip irrigation - 61.9%. Due to fertilizers, an additional 30.9% yield was obtained. Varieties and the interaction of drip irrigation and nutrition background contributed to an increase in yield by 0.5 and 1.3%, respectively. The share of influence of other factors was 5.4%.

Important indicators of the effectiveness of certain elements of the growing technology are product quality. The most important among them are the weight of the head, the yield of marketable products, dry matter content, sugars, vitamins.

On the best variants of the cabbage growing technology, the weight of the head was within the limits stated by breeders in the relevant characteristics (Table 2).

Table. 2. Influence of drip irrigation and nutrition backgrounds on the weight of white late-ripening cabbage varieties, kg ($\bar{x} \pm \sigma$ for 2017-2019)
Source: own research, research field of the Training and Production Center "Podilia" of State Agrarian and Engineering University in Podilia

Drip irrigation, factor A	Nutrition background, factor B	Variety, factor C		
		Yana – St.	Kharkivska zymova	Ukrayinska osin
Control - without irrigation	control	1,58 ± 0,25	1,60 ±0,14	1,67 ±0,26
	$N_{120}P_{80}K_{150}$	2,04 ± 0,34	2,05 ±0,25	1,97 ±0,33
	$N_{60}P_{40}K_{75}$	1,81 ± 0,19	1,94 ±0,14	1,91 ±0,18
Drip irrigation	control	2,33 ± 0,35	2,37 ±0,24	2,42 ±0,36
	$N_{120}P_{80}K_{150}$	2,84 ± 0,41	2,93 ±0,37	2,95 ±0,37
	$N_{60}P_{40}K_{75}$	2,72 ± 0,42	2,75 ±0,33	2,71 ±0,33

Compared to the control without irrigation and fertilizers, the increase in head weight due to fertilizers alone averaged 25%, drip irrigation - by 48% and fertilizers and irrigation - by 76%.

The yield of marketable products according to the variants of the experiment was high. Depending on the variants of the experiment, it ranged from 90 to 95%.

The problem of nitrate content in vegetable products is quite relevant. If the toxicity of nitrates themselves is relatively low, then the products of their reduction in a living organism - nitrites - exceed nitrates by 10-20 times. One of the reasons for the accumulation of nitrates is the mismatch between the amount of nitrate uptake from the soil and their assimilation by plants. More of them are contained in plant species in which the period of harvest ripeness occurs before physiological maturation. The content of nitrates in plants also increases in warm, humid and cloudy weather [5].

The strongest influence on the content of nitrates in plants have soil pH, the ratio between carbon and nitrogen, the capacity of cation metabolism, the content of mineral nitrogen, mobile forms of phosphorus and potassium, trace elements [8].

The content of nitrates in fresh cabbage ranged from 170 to 380 mg / kg. Cabbage of the variants where the content of nitrates exceeded the permissible standards for fresh produce (200 mg / kg) should be used in processed form.

Nitrate poisoning by fresh vegetables is possible at a concentration of nitrates> 0.35-0.45%. Severe poisoning is observed in cases where the content of nitrates in food, water, beverages is 1200 mg or more per 1 liter or 1 kg. According to the FAO / WHO, the permissible level of nitrates is 5 mg of $NaNO_3$ per day per 1 kg of body weight. It should be borne in mind that the definition of this norm does not take into account the possibility of formation of nitrosoamines from nitrates and nitrites [8].

Thus, in the conditions of the south-western Forest-Steppe of Ukraine on typical chernozem, high and stable yields of late-ripening white cabbage varieties can be ensured by

applying drip irrigation and applying mineral fertilizers to the programmed crop. The optimal calculated rate of fertilizers for white cabbage is $N_{120}P_{80}K_{150}$.

Among the studied varieties of white cabbage, the highest yield, on average, was provided by «Kharkivska zymova» (58.9 t / ha) and «Ukrayinska osin» (58.4 t / ha). In the variants without irrigation, «Ukrayinska osin» variety is the best, and with drip irrigation – «Kharkivska zymova».

Drip irrigation makes it possible to reduce significantly the cost of irrigation water, to ensure its normalized supply directly to the location of the root system and to create optimal conditions for growth and development of cabbage.

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IMPACT OF NUTRITION SYSTEM ON THE DURATION OF THE GROWING SEASON OF GARDEN PEAS IN THE WESTERN FOREST-STEPPE IN UKRAINE

Summary

Aim of the study. The purpose of the research is to identify the influence of mineral fertilizers and growth regulators on the duration of inter-phase periods and the growing season of garden pea varieties (Pisum sativum) for the period 2016-2018.

Results. It was established that the duration of the growing season of the studied garden pea varieties was average and changed depending on the nutrition by different doses of mineral fertilizers and growth regulators. The fertilization up to 15 kg/ha d.r. in combination with different growth regulators on different garden pea varieties extended the growing season from 2 to 3 days on average. Additionally, there was a tendency to increase the growing season from 7 to 8 days compared to control in terms of nitrogen fertilization up to 30 kg/ha d.r. When nitrogen fertilizers were applied in dose up to 45 kg/ha d.r. the growing season of plants continued for another 2-3 days, depending on varietal signs of culture and processing technologies.

Conclusions. The growth rate of a garden pea “Hotivskyi”, “Chekbek”, “Farhus” depended on temperature, humidity, the presence of nutrients and varietal features in the soil to a greater extend. It has been found that some plants grew quickly, accumulated enough nutrients, and matured later than those species that grew slowly in the first phases of plant development. The growing season of garden pea “Chekbek” was the smallest compared to garden pea "Hotivskyi" and "Farhus". The longest growing season for all examined varieties of garden pea was observed when we applied $N_{45}P_{30}K_{45}$ in combination with plant growth regulators. On average, during three years, the growing season of garden pea “Hotivskyi” was 86 days, the growing season of garden pea “Chekbek” was 81 days and the growing season of garden pea “Farhus” was 92 days, which

ultimately led to a decrease in yield.

Key words: variety, mineral fertilizers, plant growth regulators, growing season, yield

Introduction

The production of leguminous crops and its famous representative a garden pea (*Pisum sativum*) plays a significant role in the grain balance [1].

The grain of garden pea has a high protein content, which is an important component of people's nutrition, as well as valuable food for farm animals. Garden pea protein contains many important amino acids that contribute to its full absorption. There are many carbohydrates, mineral salts, vitamins in its grain and green mass [2, 3]. Garden pea protein is a full-value protein according to amino acid composition and is absorbed 1.5 times quicker than, for instance, wheat protein. It contains 4.66% of lysine, 11.4% of arginine, 1.17% of tryptophan (of the total amount of protein), while wheat protein contains only 2.32% of lysine and 3.56% of arginine. Accordingly, its value is not only as a food product (high gustatory qualities) but also as a dietary, therapeutic product.

It contributes to the withdrawal of salts from the body. 100 g of its grain contains 491 kcal (wheat contains 457 kcal). The protein content is almost the same as in raw meat. 1 kg of grain contains 1.17 k.o. 180 – 240 g of digestive protein, 15.2 g of lysine; 3.2 g of methionine [4, 5, 6].

The growing season of garden pea is quite an important feature that determines the possibility of garden pea growing in a particular agroclimatic region of Ukraine [7, 8].

There are periods and stages of organogenesis in the life of each plant, which coincide with certain phases of its growth and development. Observing the phenological phases of growth and their intensity, it is possible to adjust the elements of plant productivity in the programmed direction [9, 10].

Famous Ukrainian scientists A. O. Babych, A. M. Rozvadovskyi, V.F. Petrychenko [11] stated that the growing season of a garden pea can be reduced in one and a half times – up to 10 days, which can lead to a decrease in productivity.

Garden pea crops in field crop rotation allow us to solve the problem with the choice of a predecessor for winter crops. However, the longer the growing season, the more spare nutrients can be accumulated in the pea grain due to the passage of photosynthesis processes [12, 13].

Research results of other well-known scientists show that the duration of the crop growing season, including sowing peas, depends not only on the biological characteristics of plant development due to their origin but also on the influence of external meteorological factors:

temperature, light, moisture, etc. [14, 15].

The morphobiological control method allows us to study further the differentiation processes of a particular organ of a plant and reveal ontogenetic patterns of variability. Nine macro-phases pass sequentially: germination, leaf formation (main shoot), growth in length, the beginning of the formation of flowers, flowering, the formation of fruits, ripening of fruits and seeds, dieback in the process of garden pea growing [16, 17].

Purpose, subject and methods of research

The purpose of the present paper is to study the impact of mineral fertilizers and growth regulators on the formation of productivity of garden pea varieties in the Western Forest-Steppe.

Methods. Phenological observations, biometric studies, statistical processing of the data received.

Field experiments were conducted during 2016-2018 on the research field of the Educational and Production Center "Podilia" of Podillia State University, laid in research crop rotation.

The soil of the research field is deep low-humus, heavy-toed loam and typical black soil. According to the research results of the Agriculture, Soil Science and Plant Protection Department of Podillia State University, it was established that the research area is characterized by the following agrophysical and agrochemical properties of the soil: the density of the solid phase of the soil layer 0-30 cm is 2.55-2.62 g/m3; pH of aqueous and salt suspensions and hydrolytic acidity according to the Kappen method in the CIACSA (Central Institute of Agro-Chemical Service of Agriculture) modification (HOST 26212-91).

Thus, the pH of hydrogen in the upper layer is 6.8 a, hydrolytic acidity is 0.70 mg-equa./100 g of soil. The content of humus according to Thurin in the modification of CIACSA (HOST 26213-84) in the upper horizon is 3.39%. Malice density is 1.17-1.25 g/m3; total porosity is 51.6-54.7%, nitrogen content (according to Kornfield) is 13.6-14.2, phosphorus and potassium according to Chirikov (DSTU-4115-2002) is 15.7-16.4 and 22.4-26.3 mg per 100 g of soil, respectively. Absorption capacity is at the level of 20-25 mg-equa./100 g of soil.

The action and interaction of three factors: A – grade (“Hotivskyi”, “Farhus”, “Chekbek”); C – applications ($P_{30}K_{45}$ (control), $N_{15}P_{30}K_{45}$, $N_{30}P_{30}K_{45,}$ $N_{45}P_{30}K_{45}$); C – growth regulators (control – without processing, PlantaPeh - 25 g/ha, Emistym C – 30 ml/ha, Wympel - 30 ml/ha) have been examined during the experiment.

The formation of high productivity of garden pea depends primarily on weather conditions.

Analysis of air temperature according to the Hydrometeorology Center in Kamianets-Podilskyi shows that the average annual temperatures in 2016-2018 were higher than the average long-term data by 1.8 – 1.9°C (Table 1).

Table. 1. Air temperature during the research years
Source: own study

Months	**Average multi-year**	**2016**	**Deviations from average perenniaal**	**2017**	**Deviations from average perenniaal**	**2018**	**Deviations from average perenniaal**
January	– 5,1	– 4,0	+ 1,1	– 5,7	– 0,6	– 1,2	+ 3,9
February	– 3,4	3,5	+ 6,9	–1,7	+ 1,7	– 2,8	+ 0,6
March	1,7	5,0	+ 3,3	6,8	+ 5,1	– 0,2	– 1,9
April	8,1	12,6	+ 4,5	9,6	+ 1,5	13,9	+ 5,8
May	14,6	14,9	+ 0,3	15,1	+ 0,5	17,8	+ 3,2
June	18,3	20,1	+ 1,8	19,5	+ 1,2	19,7	+ 1,4
July	19,6	21,6	+ 2,0	20,3	+ 0,7	20,3	+ 0,7
August	19,2	20,5	+ 1,3	21,6	+ 2,4	21,6	+ 2,4
September	13,8	16,6	+ 2,8	15,8	+ 2,0	16,1	+ 2,3
October	7,9	6,8	– 1,1	9,7	+ 1,8	11,0	+ 3,1
November	2,7	1,9	– 0,8	4,3	+ 1,6	2,2	– 0,5
December	– 2,5	– 1,3	+ 1,2	1,8	+ 4,3	– 1,6	+ 0,9
Per year	**7,9**	**9,8**	**+ 1,9**	**9,8**	**+ 1,9**	**9,7**	**+ 1,8**

The beginning of 2016 was characterized by a short and warm winter. After the autumn severe drought during February and March, there was a slow restoration of water balance in the soil. The average air temperature in February was 3.5°C, which is 6.9°C higher than normal, rainfall was 33.9 mm (norm 40 mm). These indicators amounted to 5.0°C, 3.3°C and 15.0 mm in March (Table 2).

Table. 2. The amount of precipitation during the research years (according to the Hydrometeorology Center in Kamianets-Podilskyi)
Source: own study

Months	Average multi-year	2016	Deviations from average multi-year	2017	Deviations from average multi-year	2018	Deviations from average multi-year
January	34	26	– 8	16	– 18	23	– 11
February	40	34	– 6	17	– 23	34	– 6
March	32	15	– 17	43	+ 11	62	+ 30
April	46	14	– 32	29	– 17	16	– 30
May	61	47	– 14	29	– 32	31	– 30
June	102	141	+ 39	104	+ 2	113	+ 11
July	105	21	– 84	18	– 87	118	+ 13
August	53	62	+ 9	21	– 32	23	– 30
September	51	34	– 17	109	+ 58	21	– 30
October	30	121	+ 91	44	+ 14	31	+ 1
November	40	87	+ 47	33	– 7	33	– 7
December	32	34	+ 2	29	– 3	59	+ 27
Per year	**626**	**636**	**+ 10**	**492**	**– 134**	**564**	**– 62**

The amount of precipitation from January till March was inferior to the climatic norm by 29%, but almost all of it was absorbed by the soil. Thus, the moisture deficiency of the previous year was compensated and optimal moisture prevailed at the beginning of the active growing season of garden pea in the fields.

Such conditions contributed to the intensive growth of plant mass and outrunning phases of plant development typical for April-May against the background of elevated air temperatures. The summer period was characterized by increased temperatures in June and July (1.8 - 2.0° C above the average long-term indicators) and a large number of hot days.

The maximum rainfall was recorded in June (140.8 mm) and October (121.5 mm), the minimum was registered in March (15.0 mm) and May (14.4 mm). The first frosts were observed on October, 18, the snow cover (15 cm) was established on November, 13.

Extremely low air temperatures were recorded in 2017, which already exceeded 10 °C in the first decade. February had a higher average temperature (1.7 °C) in comparison with long-term data.

March was extremely warm and humid, so at the beginning of fieldwork, there was an optimal moistening of the soil. The temperature during the growing season of garden pea exceeded the average long-term data by 0.5 – 1.2 °C, respectively, the air temperature was not a restrictive

factor in the growth of yield.

March was extremely warm and humid, so at the beginning of field work, there was an optimal moistening of the soil. The temperature during the growing season of garden pea exceeded the average long-term data by 0.5 – 1.2 °C, respectively, the air temperature was not a restrictive factor in the growth of yield. However, insufficient rainfall in April-May (58 mm or 54% of the norm) caused a shortage of soil moisture, which led to a decrease in yield. The warmest month of the year was March – 6.8°C (+ 5.1°C), the most stable month of the year was July (17.9 mm – 17% of normal).

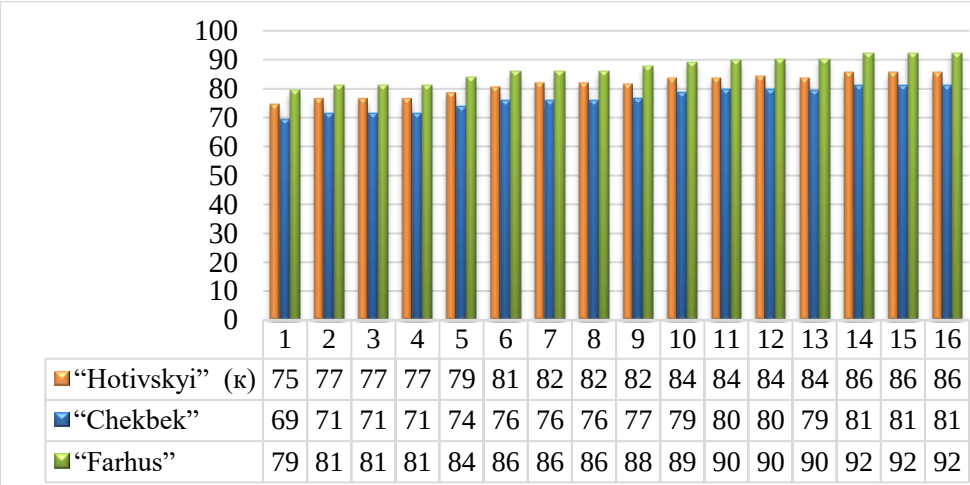
2018 was characterized by a large number of anomalies. January was 3.9°C warmer than long-term data, the rate of precipitation was 23.2 mm (2/3 of the norm); the minimum temperature was observed at the end of the month to 20° Cbelow zero. The first decade of March began with severe frosts, which reached 22 – 24 °C below zero. In general, March was cold, with a moderate cover of snow, the average temperature of the second and third decades reached only 2.0 and 1.3°C.

Extremely high air temperatures were observed after a short spring (25 days). Thus, in April, the temperature was higher on 5.8 °C, in May – on 3.2°C, in June – on 1.4°C and in July – on 0.7°C, which in total for the growing season was 11.1°C. The number of active air temperatures (above +10ºC) during April-October exceeded the norm by 500-600ºC and turned out to be the largest in the last 60 years. Due to the rapid accumulation of heat, garden pea prematurely finished growing, which led to a decrease in yield. In addition to the temperature regime, the yield in 2018 also decreased due to the uneven distribution of precipitation.

So, according to all issues of weather and climatic criteria, 2018 turned out to be the most stressful year for garden pea.

Research results

As a result of a three-year research on crops of a garden pea "Hotivskyi", "Chekbek", "Farhus", agrotechnical measures were carried out in strict accordance with the stages of plant development and made it possible to establish the relationship between the duration of micro-and macro-phases of a garden pea. Biological and ecological features, meteorological conditions such as air temperature, rainfall and varietal qualities of seeds had quite a significant impact on the duration of the growing season. Over the years, the climatic conditions were quite different, so the duration of the growing season of the garden pea we studied over the years also differed (Fig. 1).



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
"Hotivskyi" (к)	75	77	77	77	79	81	82	82	82	84	84	84	84	86	86	86
"Chekbek"	69	71	71	71	74	76	76	76	77	79	80	80	79	81	81	81
"Farhus"	79	81	81	81	84	86	86	86	88	89	90	90	90	92	92	92

*1. $P_{30}K_{45}$+(control)+without processing PPP (control); 2. $P_{30}K_{45}$+PlantaPeh; 3. $P_{30}K_{45}$+ Emistym C; 4. $P_{30}K_{45}$+Vympel; 5. $N_{15}P_{30}K_{45}$+without processing; 6. $N_{15}P_{30}K_{45}$+PlantaPeh; 7. $N_{15}P_{30}K_{45}$+Emistym C; 8. $N_{15}P_{30}K_{45}$+Vympel; 9. $N_{30}P_{30}K_{45}$+ without processing; 10. $N_{30}P_{30}K_{45}$+PlantaPeh; 11. $N_{30}P_{30}K_{45}$+Emistym C; 12. $N_{30}P_{30}K_{45}$+ Vympel; 13. $N_{45}P_{30}K_{45}$+without processing; 14. $N_{45}P_{30}K_{45}$+PlantaPeg; 15. $N_{45}P_{30}K_{45}$+Emistym C; 16. $N_{45}P_{30}K_{45}$+ Vympel

Fig. 1. The duration of the growing season of garden pea varieties depending on the nutrition of mineral fertilizers and growth regulators, days (average for 2016 – 2018)
Source: Own survey on the basis of the conducted research

It has been proved that with the samples, where nitrogen fertilizers ($P_{30}K_{45}$) were not used and the plant wasn't treated with growth regulators, the growing season was within 69 – 79 days depending on the variety. Fertilizing the plant in dosage $N_{15}P_{30}K_{45}$ and spraying garden pea with growth regulators Emistym C, PlantaPeh and Vympel, the duration of the growing days was extended up to 4-5 days on average and compiled 79 – 86 days. In the areas where mineral fertilizers were applied in the dosage of $N_{30}P_{30}K_{45}$, the duration of the growing season garden pea was extended up to 2 – 3 days and compiled 80 days for "Chekbek", 84 days and 90 days for "Hotivskyi" and "Farhus", respectively.

We found that in the areas where mineral fertilizers were applied in the dosage of $N_{45}P_{30}K_{45}$, the growing season of garden pea increased at another 1 – 2 days compared to the previous nutritional option and at 9 – 11 days compared to the control option. Thus, the growing season of garden pea "Hotivskyi" averaged 84 - 86 days, the growing season of a garden pea "Chekbek" was 79 - 81 days and the growing season of "Farhus" was 90 - 92 days, depending on the nutrition option and varietal characteristics of the crop.

Optimal weather conditions in 2016-2017 made it possible to sow garden pea seeds in the first decade of April. Late spring and insignificant snow cover of the soil in late March and early

April in 2018 delayed sowing for 12 days, that is, garden pea during the experiment was sowed at the end of the second decade of April.

On average, over three years of research, macro-phase 0 is germination and this phase occurs by 11 – 15 days depending on the variety, nutritional characteristics and weather conditions.

The beginning of leaves and the main sapling formation began in microphase BBCH-10 and ended in microphase BBCH-50, the third tendril appeared in microphase BBCH-13. The period from microphase BBCH-10 to microphase BBCH-13 ranged from 7 to 10 days, and during the period BBCH-14-50, it was 15 – 19 days, depending on the varietal characteristics of the crop and the influence of various doses of mineral fertilizers. It was proved that the increase in doses of nitrogen fertilizers assists in lengthening inter-phasic periods from 2 to 3 days on average.

The plants of experimental varieties of garden pea were treated with growth regulators in microphase BBCH 55-65. The introduction of growth regulators had a positive effect on the growth and development of plants, root system and leaf area. The inter-phasic period in the microphases BBCH 70 – 99 with the plants treated by growth regulators was reduced since these drugs contributed to the effective acceleration of certain stages of development.

Garden pea blossoming is the most important period for the formation of the future harvest. Prolonged rainy weather during this period can delay flowering, and subsequently, a larger amount of the ovary may crumble. During the years of our research, similar climatic conditions were during the flowering period in 2018, the amount of precipitation in May amounted to 73.4 mm, which caused a significant shed of flowers later on warm and sunny days with an average daily temperature of +17.8°C. At the same time, there was a tendency to preserve flowers on plants of garden pea varieties, which were sprayed with growth regulators.

During the years of research, the period BBCH 51-69 fluctuated on average in “Hotivskyi” (control) from 17 to 19 days, in “Chekbek” – from 16 to 18 days and in “Farhus” – from 19 to 22 days. Growth regulators treatment resulted in reducing the period between these micro-phases compared to areas where plants were not treated by growth regulators.

The period from the beginning of the beans formation to the time when the beans reached the grade type (green ripeness) BBCH 70 – 80, lasted for 13 – 14 days at the control areas and the plants were not treated with growth regulators.

It has been found that after growth regulators treatment by PlantaPeh, Emistym C and Vympel, garden pea crops in the micro-phases BBCH 81-99 almost did not lie down and quickly reached full ripeness, and the inter-phasic period was reduced accordingly. This period compiled 22 - 24 days with “Hotivskyi”(control), with “Chekbek” - 19 - 23 days and with “Farhus” - 19 -

23 days, which is 1 - 2 days longer than in the sample with mineral fertilizers, but without growth regulators treatment (control).

Conclusions

The growing season of garden pea “Chekbek” was the smallest, in comparison with the “Hotivskyi” and “Farhus”, which is typical for this variety. Treatment with mineral fertilizers in combination with growth regulators assists in prolonging the growing season from 4 to 9 days with garden pea “Hotivskyi” from 5 to 10 days, with garden pea “Chekbek” from 6 to 11 days and with garden pea “Farhus”. The longest growing season for all the studied varieties of garden pea was registered when we applied mineral fertilizers in doses $N_{45}P_{30}K_{45}$ in combination with the plant growth regulator Vympel. It was 86 days for garden pea “Hotivskyi”, 81 days for garden pea “Chekbek” and 92 days for garden pea “Farhus”.

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PRODUCTIVITY OF MARKETABLE PRODUCTS OF PARSLEY AND CELERY DEPENDING ON THE CALIBRATION OF SEEDS

Summary

The article presents the results of research on the impact of seed calibration on the growth, plant development and yield of parsley and celery in the Right Bank Forest-Steppe of Ukraine. Methods. Analysis, synthesis, generalization, laboratory and field experiment. Results. The paper scientifically substantiates and proves that the calibration of parsley and celery seeds by fractions significantly affects the sowing quality. Thus, the weight of 1000 seeds of parsley from the first fraction was 1.70 g, the second - 1.17 g, celery - 0.55 g and 0.30 g, respectively. Calibration of parsley and celery seeds affected the field germination of seeds. From the fraction of parsley seeds 1.75-1.50 g field germination was 21.8%, and 1.0-0.50 only 3.2%, with a yield of greens - 34.1 t / ha and 4.8 t / ha. Field germination of celery seeds from the fraction of 0.70-0.50 mm was 21.9%, and from the fraction of 0.50-0.35 mm 16.4%, which is 5.5% lower. At the same time, the yield of marketable products was 25.4 t / ha, which exceeds the second fraction of seeds by 9.0 t / ha.

Thus, when calibrating the small seeds are separated and the weight of the calibrated seeds increases. Small seeds, especially slender, have reduced germination. Large selected seeds always provide high productivity of parsley and celery plants. When sowing large calibrated seeds, it is easier to establish accurate sowing and it is possible to reduce the sowing rate.

Key words: parsley, celery, calibration, seeds, fraction, germination, yield

Introduction

Pre-sowing preparation of seeds is of great importance for increase of field germination of seeds, intensive growth of plants, resistance of sprouts against adverse conditions, reduction of

diseases defeat. Relatively low costs for pre-sowing preparation provide a high economic effect [3].

Barabash O.Yu., Ovcharuk V.I. note that pre-sowing seed preparation includes calibration into fractions by weight and size, which is one of the main measures. Seed weight depends on the varietal characteristics of the culture and growing conditions [1, 7].

When studying the methods of sowing, seeding rates of parsley and celery plants, we calibrated the seeds. In order to study the average weight, which affects the simultaneity of germination and the alignment of seedlings, which in turn significantly affects plant density and yield [5, 6].

As Barabash O.Yu. notes, the yield of greens from one plant that grew from large seeds is 1.2-2 times higher, with its high specific weight compared with plants that grew from small seeds [1]. From large seeds the plants were better developed and had a high marketable quality of impression. This is due to the fact that large seeds contain more spare nutrients, it is more viable, gives good simultaneous, aligned seedlings and increased productivity. Small seeds dramatically reduce field germination, especially with deep wrapping in the soil, thus obtaining liquefied seedlings with low plant productivity [4, 8].

Therefore, pre-sowing calibration of parsley and celery seeds is widely used in production.

Purpose, subject and methods of research

The purpose of the study was to study the influence of seed calibration on growth, plant development and yield of parsley and celery in the conditions of the Right-Bank Forest-Steppe of Ukraine.

Calibration of crop seeds was performed on special machines and sieves, also at a specific weight of 3-5%, in a solution of common salt or ammonium nitrate. The experiments were based on the research field of the Training and Production Center "Podillia" and laboratories of State Agrarian and Engineering University in Podilia during 2018-2020.

The soil of the experimental field is black soil podzolic coarse-dusty-medium loamy on forest-like loams. The content of humus (according to Tiurin) in the soil layer 0–30 cm is 2.8–3.6%. The content of easily hydrolyzable nitrogen compounds (according to Cornfield) is 9.0–11.6 mg per 100 g of soil, mobile phosphorus (according to Chirikov) 6.0–8.5 mg per 100 g of soil and exchangeable potassium (according to Chirikov) - 6.9–10.0 mg per 100 g of soil.

Seeds of parsley of the Urozhayna variety, celery - Yabluchna were sown. The estimated area of the plot is 10 m^2, repeatition is four times. Calibration of seeds was performed before

sowing in fractions: parsley seeds weighing 1000 - 1.75-1.50 g, the first fraction; 1.50-1.25 g - the second fraction; 1.0-0.8 g - the third fraction; celery seeds weighing 0.70-0.50 g - the first fraction; 0.50-0.35 g - the second fraction.

Phenological observations, biometric studies were performed according to the methods of G.L. Bondarenko, K.I. Yakovenko [2].

Research results

The results of research show that the quality of parsley and celery seeds by fractions is diverse, and significantly affects its sprouting energy and germination (table 1).

Table. 1. Influence of calibration on sieves of parsley and celery seeds on its sowing quality (average for 2018-2020)
Source: own research, research field of the Training and Production Center "Podillia" of State Agrarian and Engineering University in Podilia

Seeds fraction	Weight of 1000 seeds, g		Germination energy,%		Laboratory germination,%	
	parsley	celery	parsley	celery	parsley	celery
I	1,70	0,55	63	64	77	74
II	1,17	0,30	62	58	73	70
III	0,70	x	43	x	57	x

Thus, the seeds of the first and second fractions have a high weight of 1000 seeds, which is parsley 1.70 and 1.17 g, celery - 0.55 and 0.30 g. The seeds had a high sprouting energy, laboratory germination, which corresponds to 1 class of state standard. Lower sowing qualities of seeds were obtained from the third fraction, parsley seeds with a weight of 1000 seeds of 0.70 g, with a sprouting energy of 43%, laboratory germination of 57%, such seeds were not used for sowing. Celery seeds of the third fraction were very small and were not studied by us.

The weight of 1000 seeds of parsley and celery affects the field germination of seeds and yield (Fig. 1).

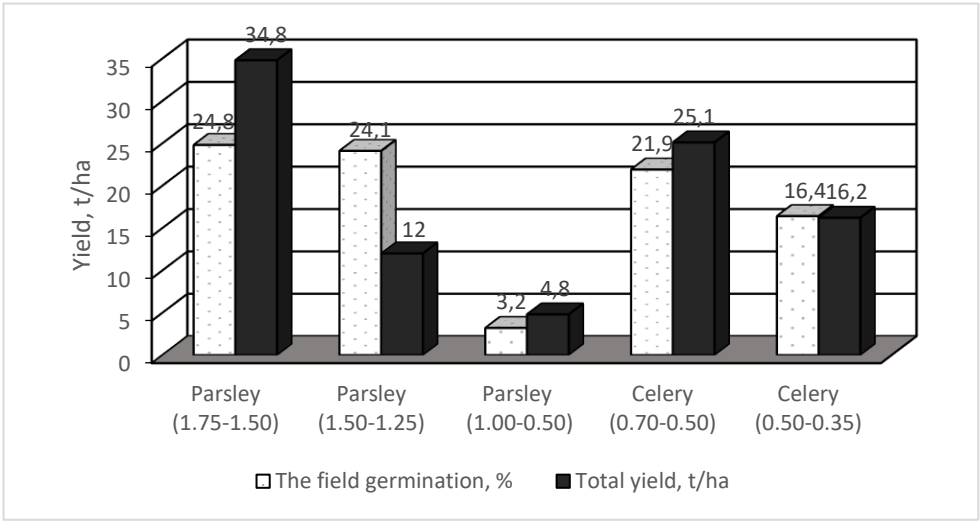

Fig. 1. Influence of the weight of 1000 seeds on the field germination of seeds and the total yield of green parsley and celery (average for 2018-2020)
Source: own research, research field of the Training and Production Center "Podillia" of State Agrarian and Engineering University in Podilia

Thus, at a weight of 1000 seeds of 1.75-1.50 g, the sprouting energy was 65.2%, while 1.0-0.50 g was 40.1% lower. This affected, respectively, the total yield of greens, and it was 33.7 t / ha compared to the weight of 1000 seeds 1.0-0, 50 mm by 16.9 t / ha lower. The sprouting energy of celery seeds with a weight of 1000 seeds - 0.70-0.50 g was 84.3% and with a weight of 0.50-0.35 g - 59.8%. The yield was 2.1 t / ha higher. The highest laboratory germination of parsley seeds was obtained from the weight of 1000 seeds 1.75-1.50 g - 73.7% with a yield of 33.5 t / ha. Whereas the fraction of 1.0-0.50 g with laboratory germination was only 30.2%, with a yield of parsley of 17.8 t / ha. Laboratory germination of celery seeds decreased by 5.5% and yield - 1.8 t / ha. Calibration of parsley and celery seeds affected the field germination. From the fraction of parsley seeds 1.75-1.50 g field germination was 21.8%, and 1.0-0.50 only 3.2%, with a yield of greens - 34.1 t / ha and 4.8 t / ha. Field germination of celery seeds from the fraction of 0.70-0.50 mm was 21.9%, and from the fraction of 0.50-0.35 mm 16.4%, which is by 5.5% lower. At the same time, the yield of marketable products was 25.4 t / ha, which exceeds the second fraction of seeds by 9.0 t / ha.

Yields of parsley and celery marketable products, in addition to seed calibration, will depend on the water absorption capacity of seeds and germination temperature of the above crops. Calibrated seeds were germinated at temperatures of + 25 °C, weighed every 24 hours in triplicate. The results of our studies showed that the bulk of water seeds of parsley (100.0-114.9%) and

celery (135.8-150.4%) of its weight absorbs on the first day of germination (table 2).

Table. 2. The effect of calibration and weight of 1000 seeds of parsley and celery on the water absorption capacity of seeds (average for 2018-2020)
Source: own research, research field of the Training and Production Center "Podillia" of State Agrarian and Engineering University in Podilia

Seeds fraction, mm	Weight of 1000 seeds, g	Water absorption,% to absolute seed weight, hours		
		24	48	72
Parsley				
Uncalibrated-control	1,0	105,1	133,0	137,9
1,75-1,50	1,70	114,9	124,8	128,0
1,50-1,25	1,17	100,0	112,5	121,1
1,0-0,80	0,70	100,8	134,7	144,0
Celery				
Uncalibrated-control	0,5	120,1	150,4	157,2
0,70-0,50	0,7	150,4	180,1	174,1
0,50-0,35	0,58	135,8	169,3	182,0

Studies have shown that at a temperature of + 25 °C for the first 24 hours of water absorption of seeds depends on its size. Thus, a large parsley with a weight of 1000 seeds of 1.70 g - 114.9%, celery with a weight of 1000 seeds - 0.70 g - 150.4% absorbed the most water. At 72 hours, the water absorption of seeds increases and reaches, respectively, crops and fractions: 112.5-184.7% and 120.1-150.4%. At 48 hours, parsley seeds (under control) absorb 133.0% of water, celery - 150.4% of their absolute weight. Whereas in the seed fraction of 1.75-1.25 mm, its absorption decreased by 8.2-10.5%, respectively. Small seeds (1.00-0.50 mm) increase water absorption compared to larger - 15.0 -1.25 mm by 16-23% depending on the fraction. We observed the same regularity of moisture absorption by celery seeds. When the fraction of parsley seeds (1.50-1.25 mm), celery (0.70-0.50 mm) after 48 hours 124.8 and 180.1%, respectively, that in comparison with the control version of parsley is 8.2% lower , celery - 29.7% higher. Such a high water absorption capacity of parsley and celery seeds depends primarily on their chemical composition, namely: the content of protein in the seeds, which parsley contains - 12.87-19.75%, celery - 20.81-23.97%, starch 7.73-10.34% (parsley), 6.22-9.34% (celery) on a completely dry weight.

We also found that sown seeds in open ground fall into other conditions of germination. First of all, the rate of its germination in the soil depends on the water and temperature regimes, which ultimately affects the printability of seed germination (Table 3).

Table. 3. The effect of soil moisture on the germination rate and field germination of parsley and celery seeds (average for 2018-2020)
Source: own research, research field of the Training and Production Center "Podillia" of State Agrarian and Engineering University in Podilia

Soil moisture from its full humidity,%	Number of days before germination		Field germination of seeds,%
	Single	Mass	
Parsley			
60	5,4	9,9	28,7
80	11,9	15,4	21,0
Celery			
60	6,5	14,0	23,8
80	8,3	18,3	17,6

The fastest sprouts of parsley and celery appear at a soil moisture content of 60% of the total moisture content: single shoots of parsley after 5.4, celery 6.5 days, respectively, after 9.9-14.0 days. At this soil moisture, the highest field germination of seeds - parsley - 28.7%, celery - 23.8%. Decrease in soil moisture to 40% and especially to 20%, from full humidity delays emergence of single sprouts of parsley for 4,6-18,7 days, celery - for 7,7-19,8 days, weight for 8,5- 27.0 and 8.3-38.1 days, respectively, and significantly changes the field germination of parsley seeds by 4.8-12.6, celery - by 4.9-12, 6%, respectively, this phenomenon is observed mostly during the dry summer.

Increasing soil moisture to 80% of total humidity also has a negative effect on the period of germination, and especially on the field germination of seeds, which in comparison with soil moisture 60% decreased by 7.7% in parsley, by 5.8 % in celery.

Studies have also shown that these are also affected by the air-gas regime of the soil. Such soil moisture weakens the access of oxygen to the seed germ, resulting in delayed germination, which often leads to plant death.

Parsley and celery seeds during germination are demanding not only moisture but also heat. It is established that the seeds of crops belong to the second group in terms of heat demand. The seeds begin to germinate at a temperature of + 2- + 3 °C, so it can be sown very early in spring and winter before the soil freezes. Thus, when sowing seeds for the winter hardens in the soil, so that the seedlings appear in early spring and tolerate temperature fluctuations. To study this issue in detail, we conducted a study of how temperature affects the intensity of seed germination and its field germination (Table 4).

Table. 4. The influence of air temperature on the duration of seeds germination of parsley and celery and its field germination (average for 2018-2020)
Source: own research, research field of the Training and Production Center "Podillia" of State Agrarian and Engineering University in Podilia

Indicator	Temperature, °C					
	5	**8**	**12**	**18**	**25**	**30**
Parsley						
Beginning of germination, days	18	14	18	6	7	15
End of germination, days	27	25	15	8	9	21
Field germination,%	21,8	23,2	23,8	26,5	27,1	20,0
Celery						
Beginning of germination, days	19	14	10	7	6	4
End of germination, days	28	23	16	9	8	6
Field germination,%	14,5	15,6	21,3	29,2	24,1	20,1

The results of research show that the seeds of parsley and celery begin to germinate at + 5 °C and + 8 °C. The germination period for parsley is 22 and celery - 28 days, respectively. As the temperature rises to 8 °C for parsley seeds and 10 °C – for celery seeds creates optimal conditions for the beginning of their germination. Parsley seeds germinate most amicably and completely. Increasing the temperature to 30 °C prolongs the germination period by 10-13 days. While the germination of celery seeds decreased by 3-4 days. At a temperature of 34 °C plant seeds do not germinate. Therefore, the optimum temperature for germination of parsley and celery seeds is 18-25 °C.

Soil temperature affects the field germination of parsley and celery seeds. At low temperatures (+ 5-8 ° C) field germination of parsley seeds is 21.8-23.2%, celery - 14.5-19.6%. With increasing temperature (+ 12-18 °C) the field germination of seeds increased respectively: parsley by 2.0-3.3% and celery by - 6.8 - 7.8% compared to the temperature regime + 8-11 °C. The increase in temperature to + 25 °C field germination of parsley seeds was 27.1%, celery - 24.1%.

Analyzing the research results, it should be noted that the low field germination of parsley and celery is due not only to moisture and temperature, but also to quality seeds, which is closely related to external conditions: heat, light, moisture, nutrition, etc. Seed germination and field germination in general depend on these factors.

Conclusions

Calibration of parsley and celery seeds by fractions is different, and significantly affects

sowing quality. Thus, the weight of 1000 seeds of parsley from the first fraction was 1.70 g, the second - 1.17 g, celery - 0.55 g and 0.30 g, respectively. Calibration of parsley and celery seeds affected the field germination of seeds. From the fraction of parsley seeds 1.75-1.50 g field germination was 21.8%, and 1.0-0.50 only 3.2%, with a yield of greens - 34.1 t / ha and 4.8 t / ha. Field germination of celery seeds from the fraction of 0.70-0.50 mm was 21.9%, and from the fraction of 0.50-0.35 mm 16.4%, which is 5.5% lower. At the same time, the yield of marketable products was 25.4 t / ha, which exceeds the second fraction of seeds by 9.0 t / ha.

Thus, when calibrating the small seeds are separated and the weight of the calibrated increases. Small seeds, especially slender, have reduced germination. Large selected seeds always provide high productivity of parsley and celery plants. When sowing large calibrated seeds, it is easier to establish accurate sowing and it is possible to reduce the sowing rate.

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ELEMENTS OF CULTIVATION TECHNOLOGY AND RAW MATERIAL REALIZATION OF CHAMOMILE BY AGRICULTURAL COMMODITY PRODUCERS

Summary

When growing medicinal plants, the main condition is the right choice of agricultural techniques and accuracy of actions in the cultivation process. Nowadays, medicinal plants are becoming more and more relevant among agricultural producers of Ukraine and the world market, because from the sale of medicinal raw materials you can get a steady income. The aim of our research was to develop and improve elements of growing technology for chamomile (*Matricaria recutita L.*) in the Right Bank Forest-Steppe zone of Ukraine and to establish the impact of changing the growing season by sowing plants, to extend the flowering period and optimal seeding rates. Chamomile varieties Perlyna Lisostepu and Bodegold were used for these studies.

Recommendations on the territorial organization of medicinal plant raw materials production are substantiated, taking into account the natural and climatic conditions, variety, seeding rate and sowing date for the sale of raw materials by commodity producers. It is proved that the maximum indicators for the formation of chamomile plants yields were observed during the autumn sowing period with a highly productive variety Perlyna Lisostepu and seeding rates of 6.0 kg / ha with a profitability of 146 %.

Key words: raw chamomile, variety, seeding rate, sowing date, sale

Introduction

In modern conditions, the cultivation of medicinal plants should be considered as market element of medicinal plant raw materials. Medicinal crop production together with cultivated

species and harvesting of wild medicinal and technical raw materials forms the raw material base of this market, so in accordance with modern conditions of society ecological and economic determinants should become one of the important prerequisites for sustainable production and processing of medicinal plants. Given the existing and constantly growing demand for medicinal plant raw materials, the study and justification of strategic priorities of the state in this area plays an important role. In the economically developed countries of the world, this field of research is one of the most profitable.

In Ukraine, the market of medicinal plants is regulated by the Laws of Ukraine "On Medicinal Products", "On Licensing of Certain Types of Economic Activity", the Tax Code of Ukraine, the Resolution of the Cabinet of Ministers of Ukraine "On State Quality Control of Medicinal Products" and others. At present in Ukraine it is extremely important to attract investment in the development of new modern drugs and clinical trials, advertising of developed drugs, as the cultivation of medicinal plant raw materials is only the first step in obtaining significant profits [9].

To date, the main documents that determine the authenticity, purity and quality of MPL are: State Pharmacopoeia of Ukraine (SPU), some pharmacopoeial articles (PA), pharmacopoeial articles of the enterprise (PAE), state standard (SSTU), industry standards (GST), enterprise standards (EST), technical conditions (TC) and technological instructions (TI). The requirements specified in the documents are mandatory for all enterprises and institutions of Ukraine that manufacture, store, control and use medicinal raw materials [12].

In particular, in Ukraine there is a State Pharmacopoeia, which is harmonized with the European Pharmacopoeia, it includes 173 monographs on medicinal plant raw materials with quality control in accordance with EU requirements [3]. The Order of the Ministry of Health № 118 of 14.02.2013 approved the Instruction ST-N of the Ministry of Health 42.4.5: 2012 "Medicines". Good practice of cultivation and harvesting of raw materials of plant origin "[5].

The question of production development of medicinal crops and trade in them has been studied by many domestic and foreign scientists, and research has been carried out and is being carried out both in the context of the world and in the context of individual countries.

Organizational and economic issues of raw material production of medicinal plants were studied by scientists-scientists: O. Berezin, O. Gubanov, N. Karpenko, I. Markina, T. Mirzoeva, B. Semak, Yu. A. Nikitiuk and others. For example, scientists Pyakurel D., Bhattarai Sharma I., Smith-Hall S. studied the changes in the trade of medicinal plants in Europe over the past 17 years and identified the main factors that cause these changes [13].

International statistics show a growing trend in the use of medicinal plants and the

development of trade in these plants in recent decades. In Ukraine, over the past three years, the cultivation of medicinal crops has increased by about 67% [16].

The largest producer of medicinal plant raw materials is Europe, where the value of medicinal plant products is 7.5 billion US dollars, or 40% of the world market. The world's most powerful markets for medicinal and aromatic plants are China, Egypt, France, Germany, Italy, Japan, Spain, the United Kingdom and the United States. Japan is the world's largest consumer of natural medicines per capita [9].

As an initial element uniting the enterprises of the raw material link for the purpose of carrying out the coordinated procurement, production and sales policy, we recommend to form the integration association of market participants of medicinal plant raw materials. The main functions of creation and activity of the integration association of producers and primary processors of medicinal plant raw materials should be: development of production, primary processing and sale of medicinal plant raw materials; coordination of production activities of participants; information support of participants; assisting the members of the integration association in expanding their opportunities for industrial and social development.

In the field of medicinal plant formation, a core of large specialized enterprises, small and medium-sized enterprises has been formed. In addition, some agricultural enterprises use medicinal plants in crop rotations or grow medicinal plants as ancillary activities. The average sown area in large enterprises is 248.7 hectares, in medium 68.2, and in the so-called mini-farms - 5.4. Experts note that it is especially profitable to sell chamomile abroad: you can get about 200 UAH per kilogram. Factors complicating the achievement of high economic efficiency of medicinal plants production in general and chamomile in particular are, first of all, the seed base - in Ukraine it is extremely difficult to find quality seeds, and, secondly, technical support [7].

In order to develop effectively the market of medicinal plants, it is necessary to rationally form the areas of their cultivation, taking into account the requirements of plants for growing conditions, according to environmental, economic and social prerequisites for their cultivation. Based on this, in agricultural enterprises specializing in the cultivation of medicinal plants, it is advisable to organize production on the basis of rational organization of agricultural land, ie to establish the economic purpose of each plot of land based on a comprehensive environmental and economic assessment of land. This makes it possible to identify factors limiting the organization of crop production in the economy, and to develop a system of organizational, technological and management measures for the use of agricultural land, taking into account the resource potential of the enterprise, environmental conditions and market requirements of medicinal plants [8].

Assessment of land suitability for growing medicinal plants should be carried out on the

basis of existing experience of different types of zoning. Along with the generally accepted physical-geographical, climatic, soil-geographical, economic zoning, there are types of zoning, which take into account the natural properties of the territory (climate, soils, terrain, humidification conditions, etc.). These types of zoning of the territory are substantiated by significant theoretical and practical developments [15].

Materials of natural-agricultural zoning were used in the development of farming systems. Continuation and expansion of this type of zoning is the classification of lands, which allows more careful consideration of relief, soils, moisture conditions and more. To select the type of zoning in order to assess the suitability of land for growing chamomile plants on the basis of available information on the requirements for growth conditions should form the principles, differences of taxonomic units, factors taken into account in the production of this raw material [18].

As one of the most valuable medicinal plants, chamomile has naturally constantly attracted the interest of researchers in the field of medicine and scientists in the field of cultivation and introduction.

The healing properties of chamomile have been studied since the time of Hippocrates, Pliny, Dioscorides, Galen and Asclepius. The healing properties of chamomile substances have been proven experimentally and confirmed in clinical settings. Hamazulene and its reduction products - postazulen and bisabobol - have anti-inflammatory effects, and bitter glycoside - relaxes smooth muscles. Raw chamomile is part of the drugs: "Romazulan", "Rekutan", "Kamident Health", "Antiseptol H", "Dentinox gel H" (anti-inflammatory and wound-healing effect); complex drugs "Rotokan", "Fiton SD", "Alorom", "Gastrolit", "Kamistad", "Kamilofan", "Kamagel", "Kamilozan", "Sage Dr. Theiss", "Ingalipt-Health forte with chamomile "(antimicrobial action), "Gastrophyte", "Bronchophyte", "Detoxify", "Nephrophyte", "Elecaphyte-Viola", "Phytobronchol", "Salvat", "Phytogastrol", Treatment and prevention fees № 1, 3 and 4 [4, 17].

Chamomile flowers have antispasmodic, anti-inflammatory, mild sedative, carminative and antimicrobial effects. They are used for the symptomatic treatment of gastrointestinal diseases such as stomach upset, flatulence and indigestion. Infusion of chamomile flowers is used in mild cases of insomnia. Externally, chamomile infusion is used to treat inflammation and irritation of the skin and mucous membranes. The effectiveness of growing chamomile largely depends on agricultural techniques. The number of sown seeds, sowing dates are very important to obtain the optimal density of standing plants, which provides the maximum yield of quality seeds [6, 11].

Purpose, subject and methods of research

The purpose of the article is to substantiate the integrated market mechanism of medicinal plant raw materials with intensive technology of growing modern high-yielding varieties of chamomile and justify sowing dates at optimal seeding rates, establishing phenological, technological and phytochemical parameters of the plant. their most effective development.

General scientific and special research methods were used in the work.

The study of technology elements of growing chamomile was carried out during 2017 - 2020, taking into account the agro-climatic conditions of Stara Ushytsya village Kamyanets-Podilsky district of Khmelnytsky region, on the basis of a base of medicinal plants, which allowed to make maximum use of natural resources on the growth and development of this culture [10].

High-yielding tetraploid varieties were used in the experiment, Perlyna Lisostepu and Bodegold, which are included in the State Register of Plant Varieties of Ukraine and the Federal Republic of Germany [1, 3, 10].

Chamomile is an annual herbaceous plant. The root system is rod-shaped, strongly branched. Stem is erect, cylindrical, glabrous, branched, 15 to 60 cm tall. Leaves are alternate, glabrous, sessile, broadly lanceolate or ovate in general, 15 to 60 mm long (usually 20 to 30 mm), 5 to 30 mm wide 18 mm (usually - from 10 to 15 mm), twice or thrice pinnately dissected into thin narrow filamentous segments (up to 0.5 mm wide). Flowers are small baskets up to 25 mm in diameter on long peduncles, collected in a thyroid inflorescence. Pedicel is naked, small-pitted, hollow, at the beginning of flowering hemispherical, at the end it is conical; marginal flowers are pistillate, ligulate, white, middle flowers are bisexual, tubular, yellow [2].

The most important factors influencing crop production technologies are global climate change, soil resource potential and ecological and economic conditions.

The soils of the study area are gray forest on carbonate forest, forest-like loam, sandy-clay deposits of rivers and weathering products of crystalline rocks, which have a characteristic of low humus content (according to Tiurin) - 1.97%.

Relatively low indicators of heat supply of 2500°C - 2700°C were observed. The predecessor is winter wheat. The area under the chamomile was chosen in such a way that it can be grown for at least 2 - 3 years, as its seeds from mature baskets crumble and give a thick samosas. Tillage for chamomile was carried out in separate areas, in special grain crop rotations with short rotation. The cleanest areas were chosen for sowing. Varietal seed material from different botanical and geographical zones was used in the research. The experiments were performed in an open sunny area, fertilizers and watering were not used. Plant care throughout the years of research consisted of mechanized weeding, loosening between rows, and thinning of plants in

variants.

The main, fallow plowing was carried out as early as possible to a depth of 22 - 25 cm. Cultivators equipped with pointed paws were used for pre-sowing tillage. Cultivation was carried out simultaneously with harrowing with toothed harrows, and in case of insufficient soil moisture - with rolling. For better leveling of the soil surface and high-quality sowing, cultivation was carried out at an angle to plowing to a depth of 4 - 6 cm. In spring, the main tillage consisted of pre-sowing cultivation, and it was sown simultaneously with the early spring crops with vegetable planters to a depth of 0.5 cm, in a wide row on the background of organic fertilizers 15 t / ha [10]. Analysis of climatic conditions of the post-harvest period of intermediate crops indicated the possibility of growing chamomile in the summer sowing, namely, repeated sowing, post-harvest crops.

The seeds began to germinate at a temperature of 4 - 5°C, the optimum germination temperature is 20 - 25°C. Seedlings are very heterogeneous, so do not tolerate drying of the top layer of soil. During the first 20 to 30 days after shoots emergence, the plants formed a rosette of 6 to 9 leaves.

Flowering of chamomile under normal growing conditions began 40-50 days after shoots emergence and continued until late autumn (one of the sowing dates is autumn).

Methodical assessment of a set of field and laboratory studies on this scientific work involved determining the quality of experiments, namely: adherence to a scientifically sound scheme of culture, timely and quality soil preparation in accordance with technological maps of growing new chamomile varieties of the relevant botanical taxon, taking into account agrochemical survey; laying down field experiments, conducting phenological observations and biometric measurements in the appropriate phenological phase of growth and development; harvesting and accounting of the crop with further processing of the results as a whole. During the bookmark of the field experiment, observations and records have always followed the principle of a single logical cancellation.

The growing season for chamomile, as an annual species, is the time that lasts from seed germination to its harvest ripeness. Since the spring transition of the average daily temperature through 5°C determines the beginning of vegetation for early crops, this value of temperature is associated with the beginning of mass field work, sowing of early spring crops, intensive recovery of winter crops. The growing season of these crops ends with a stable autumn transition of average temperature through 5°C, so this period of time is called the growing season [10].

Active growth and development of most agricultural plants takes place at an average daily temperature above 10°C. Speaking of the season of active vegetation, we mean a stable period

with an average daily temperature above 10°C.

From a biological point of view, the vegetation of chamomile plants began with the appearance of the first true leaves. From an economic point of view, the vegetation of the plant lasts "from seed to seed", ie from the moment of seed germination and until the formation of seeds of the newly formed plant. During the growing season, the implementation of the genetic program of the plant continues, its internal state changes, as well as its appearance.

These changes in the plant are referred to as phases of growth and development, or phenological phases. Thus, the phenophases in the plants of the chamomile studied by us are the periods in the life of the plant: sowing, germination, shoot formation, budding, flowering and ripening [14].

The growing season is very short - from seed germination to flowering 50 - 70 days. Each basket blooms for 8-10 days. The full development cycle lasts for 3-4 months.

The field germination of chamomile plants on average over the years of research was in the range of 71 - 88%, depending on the factors studied. These techniques contributed to better survival of chamomile plants (fruiting phase), where the figure was 92% during the autumn sowing period at a sowing rate of 6 kg / ha of Perlyna Lisostepu variety [10].

Obtaining three harvests a year from one area is characterized by high management intensity, which allows to increase the productivity of 1 hectare by 30 - 80%. Such sowing is an indicator of the correct use of arable land in economic terms.

Yields of chamomile for post-harvest sowing are less than in the case of spring. At the same time, chamomile grows intensively during summer sowing, accelerates the process of phenological phases, blooms earlier and forms fruits. At such sowing dates, the growing season of chamomile is reduced by 15 - 20 days or more. The real yield varies greatly in different climatic areas and depends on many factors [10, 11].

Medicinal plant raw materials are profitable and highly profitable among the sales of producers in the field of agro-industrial complex and pharmaceutical industry in Ukraine and abroad, provided that the quality characteristics are met.

Research results

Chamomile (*Matricaria chamomilla L.*) is one of the important medicinal herbs, which is also grown in Hungary, France, Yugoslavia and Brazil. It was brought to India during the Mughal period, and is now grown in Punjab, Uttar Pradesh, Maharashtra, Jammu and Kashmir. The plant can be found in North Africa, Asia, North and South America, Australia and New Zealand.

Hungary is a major producer of plant biomass. In Hungary, chamomile also grows abundantly on poor soils and is a source of income for the poor in these areas. Flowers are exported to Germany in bulk for oil distillation [2, 7].

Today, this culture is quite common and is cultivated independently of the first established areas of cultivation and existing research stations of medicinal plants, and in particular as a culture of a wide range of uses of raw materials.

Yield accounting in our studies was performed from each variant of the experiment and the average of all 4 replicates was determined. The fate of the future harvest largely depended on the method of sowing or in other words - the horizontal distribution of plants on the sown area.

Analysis of variance showed that in terms of factors, more influential - 61.2% was factor B (sowing date), factor C (seeding rate) affected 34.9%, factor A (variety) was less influential - 2.4 %, because the studied varieties of chamomile belong to one selection group of derived tetraploid varieties, and the share of influence of other unexplored factors was only 1.5% (Fig. 1).

The yield of seeds of many crops, including chamomile, was influenced by both biological and technological factors. If the distribution of precipitation and heat regime are uncontrollable factors, then the variety is a factor that must be adapted to growing conditions.

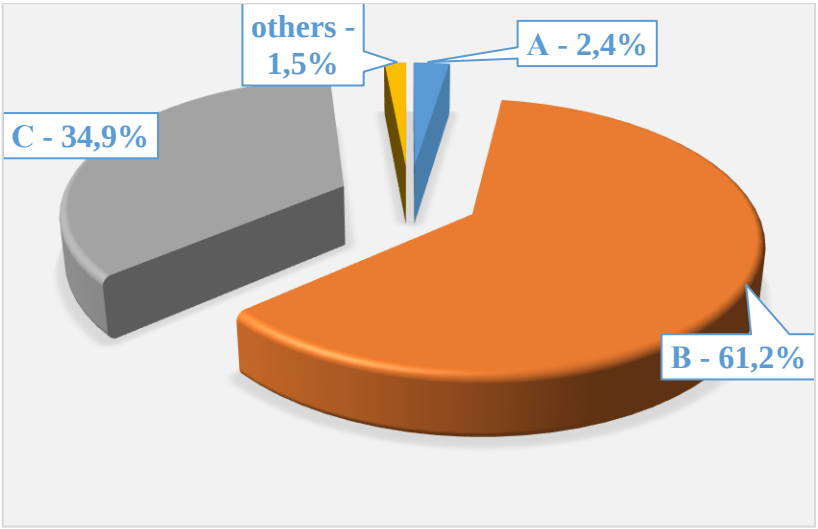

Fig. 1. The influence share of factors on the yield of raw chamomile (A - variety, B - sowing date, C - seeding rate), (average for 2017 - 2020)
Source: own research

And the method of sowing should be extremely important. For the experiment, we took two different morpho-biological features of chamomile. The yields of chamomile varieties were

different, the yield of the Perlyna Lisostepu variety on average over the years of research ranged from 0.85 to 1.75 t / ha, and the Bodegold variety - 0.78 - 1.64 t / ha.

It should be noted that more productive in the conditions of our zone was a variety of chamomile Perlyna Lisostepu, which is more resistant to temperate climates.

With the help of indicators, in Figure 2. consider how the economic efficiency of raw materials production of chamomile varieties has changed depending on the studied factors.

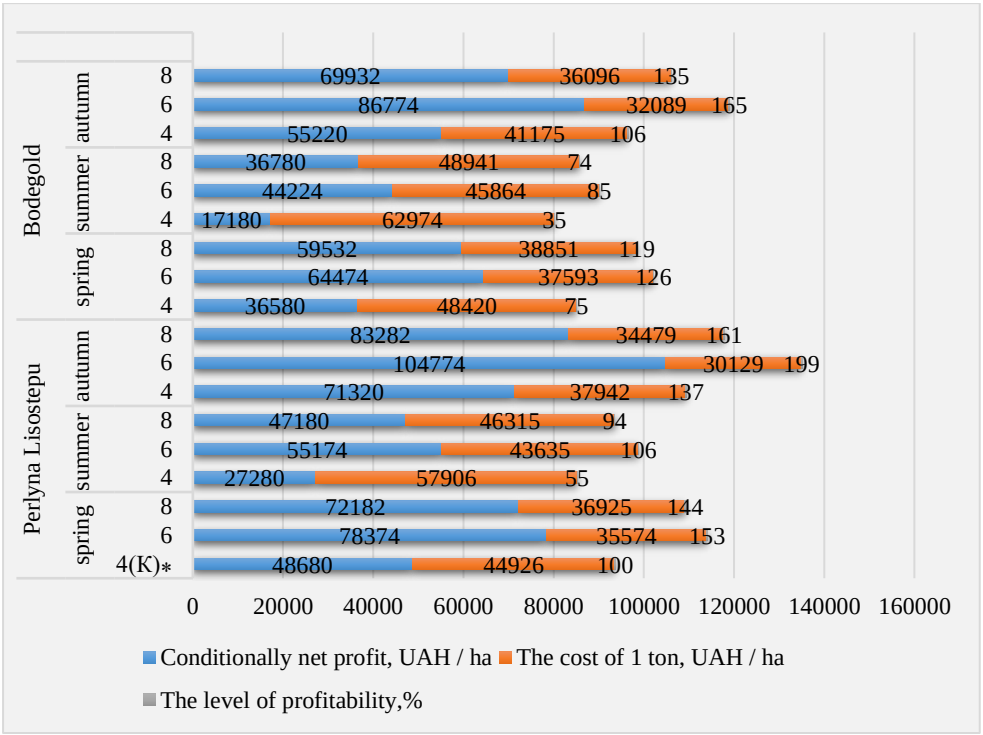

Fig. 2. Indicators dynamics of economic efficiency of growing chamomile depending on the variety, seeding rate and sowing date (average for 2017-2020)
Source: own research

At the same time, technological measures were taken to grow chamomile, which are able to form a high yield, increasing the profitability of its production.

Conclusions

Thus, in the course of the analysis of medicinal plants market key aspects of market development of the chamomile species were identified, among which there is a growing demand for phytoproducts in recent years, which can be achieved through the use of cultivated raw

materials of high yielding varieties. In the conditions of sustainable development, if it is necessary to pursue a policy of import substitution, increase employment, the organization of environmentally friendly production of medicinal plant raw materials is one of the key factors determining the effective development of this industry. The study of the domestic market has shown that in order to reconcile the interests of market participants and their most profitable cooperation, it is necessary to actively develop integration associations of the agro-pharmaceutical complex. The prospects for the development of the market for medicinal plants should be linked primarily to ensure security in the supply of herbal medicines to the public. The government should be interested in creating conditions for attracting domestic investors to this business. To do this, Ukraine needs to create a favorable investment climate in the studied market, make greater use of world experience and the gradual globalization of the domestic economy.

According to the results of many years of research, to obtain high yields, on gray forest soils it is advisable to grow a variety of chamomile Perlyna Lisostepu during the autumn sowing period at the optimal seeding rate of 6 kg / ha and without chemicals to produce organic products which will be widely sold by agricultural producers in Ukraine and abroad.

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CURRENT STATE AND ISSUES OF IMPROVING THE MAINTENANCE OF THE STATE LAND CADASTRE IN UKRAINE

Summary

The article considers some issues related to improving the quality of land cadastral data in Ukraine. Article 14 of the Constitution of Ukraine and Article 1 of the Land Code of Ukraine stipulate that land is the main national wealth under special state protection.

The earth was and remains the main source of satisfaction and paramount human needs - is the most important part of all production processes and therefore is of great importance in human life. Human life is inconceivable without the continuous use of land resources as a material factor and object of social relations. When human labor (living and tangible) joins the earth, it becomes not only a means of production involved in the system of agricultural or forestry production, but also acts as a material condition and as an active factor - the main means of production. In this case, it is both the subject of labor and a direct means of labor, because it has a unique distinguishing feature - fertility, ie the ability to reproduce plants, providing them with essential nutrients.

During the land reform in Ukraine, a number of unresolved issues arose that contribute to abuse in the field of land management and evasion of the State budget.

Entering information into the State Land Cadastre and using such information is carried out exclusively on the basis of the Law. Creating an effective land cadastre system is one of the most important prerequisites for sustainable development of market land relations, because the state land cadastre is responsible for solving the problem of accounting for all units of land ownership, only on its basis is a real guarantee of land rights; land for fiscal and regulatory purposes.

At the same time, the publicity of cadastral data must be combined with maintaining the

confidentiality of personal information, as required by the Law of Ukraine "On Personal Data Protection"

Therefore, the implementation of these legislation is impossible without the proper control over the implementation of land management and cadastre and topographic, geodetic and cartographic activities.

Key words: land management, cadastre, land inventory, land relations, registration of rights, public cadastral map

Introduction

Reforming land relations in the direction of denationalization and privatization of land in order to increase the efficiency of its use and protection is accompanied by a set of land management and land cadastral actions of both legal, organizational and economic nature. Land reform in the country shows that it needs a clear data system of land cadastre, which is designed to provide the necessary information to public authorities and local governments, interested enterprises, institutions and organizations, as well as citizens to regulate land relations, rational use and protection of land , determining the amount of payment for land and the value of land as part of natural resources, control over the use and protection of land, economic and environmental justification of business plans and land management projects [1].

The data set of the cadastral system of Ukraine is similar to European countries. In contrast to our state, in European countries there is a clear predominance of the fiscal function of the state land cadastre, because historically there is a need for land accounting for tax purposes.

In the cadastral systems of post-socialist countries (Belarus, Romania, Ukraine) to the general data, namely: information on the owner / land user, information on the location of land, restrictions and encumbrances, assessment of land, information on their quality characteristics [2]. That is why the SLC center, referring to the fact that our SLC is one of the largest in Europe in terms of data, explains that mistakes are a common thing. After all, no cadastre in the world has done without them so far.

The issue of improving the maintenance of the state land cadastre and registration of rights to real estate in Ukraine is covered in the works of a wide range of domestic scientists, such as A.S. Danylenko, Yu.O. Karpinsky, V.V. Kulinich, A.A. Liashchenko, L.Ya. Novakovsky, M.G. Stupen, A.M. Tretiak, and some others. Many scientists in their research concern the protection and rational use of land, land optimization, consolidation of natural resources.

State Land Cadastre is the only state geoinformation system of information about lands

located within the state border of Ukraine, their purpose, restrictions on their use, as well as data on quantitative and qualitative characteristics of lands, their assessment, the distribution of land between owners and users [3].

Purpose, subject and methods of research

The purpose of the article is to analyze some problems of the State Land Cadastre (SLC) at the present stage of development of land relations in Ukraine and to study ways to solve them. The materials of the state land cadastre are widely used in land management and organization of the territory of agricultural formations. Data from the state land cadastre allow to differentiate the value of land for rational use. Their protection should be carried out according to the agro-industrial grouping of soils and natural-agricultural zoning of the country. Thus, the state land cadastre becomes more important at different levels of economic planning and land management [4].

An important component of the state land cadastre is the economic evaluation of lands for various purposes, which is carried out for a comparative analysis of the efficiency of their use. Data of economic valuation of land is the basis of monetary valuation of land for various purposes. Simultaneously with the strengthening of the role of state land cadastre data, the role of monetary valuation of land plots, which is determined on a rent basis, has significantly increased. The normative monetary valuation of land plots is used to determine the amount of land tax, losses of agricultural production, economic incentives for rational use and protection of land, etc. Expert monetary valuation is used for civil law agreements on land.

Research results

Today, the role of the state land cadastre is growing significantly, as it is an information base for effective land management, land statistics, land management, regulation of land relations, support for tax and investment policy, land market development and justification of land fees.

It should be note that in accordance with the Law "On Land Cadastre", other cadastres are created on the basis of SLC [5]. For example, in the urban cadastre, complete and reliable information about land plots should be superimposed in layers with data on buildings already located on these plots, on all possibilities and restrictions on their further development, on greenery, enterprises, utilities, architectural monuments, etc.

It is known that the continuous inventory of land in Ukraine since the 90s of the last century

is the beginning of land reform, was not carried out due to insufficient budget funding and due to poor organization of implementation by city, town and village councils. For example, the planned expenditures of the State Committee for Land Management in 2009 on land reform measures amounted to only 3.5 percent of the need, and on the rational use of land resources - 18.8 percent. Methods of administrative-command "acceleration" of land privatization have also been used repeatedly. As a result, incompleteness and inaccuracy of information on all land plots in the SLC became incomplete. In fact, geospatial information is currently available in the land cadastre only for half of the state's land plots. Others will appear in the land cadastre as the cadastral surveys are carried out related to the fixation of the actual boundaries of these plots in kind (on the ground).

We see problems especially clearly when there are old state acts or old lease agreements without a cadastral number. The citizen registers the land plot and notices that the metric of his plot does not coincide with what is drawn in the state act, although the plot on the ground has never been changed, the fences have been standing for over thirty years.

Although there is currently no more than half of the data on land plots in the cadastre, there is already confusion - a certain allotment may belong to several people at the same time. And according to unofficial data given in the article of the Voice of the Capital, today out of more than 17 million land plots reflected in the SLC, about 3.5 million are superimposed on each other.

Until 2003, information had been collected on paper and separated. So, technically no one could bring them together on one electronic map. In 2003, they began collecting information electronically (exchange files) to start automation.

On January 1, 2013, with the adoption of the Law "On the State Land Cadastre", we received a public cadastral map on which, as if from a bag, the entire amount of data that had accumulated in electronic form was shaken. And immediately everyone saw what had been achieved [6].

In the public cadastral map, one of the problems of the State Land Cadastre is the imposition of land plots (Fig. 1) visually looks like this:

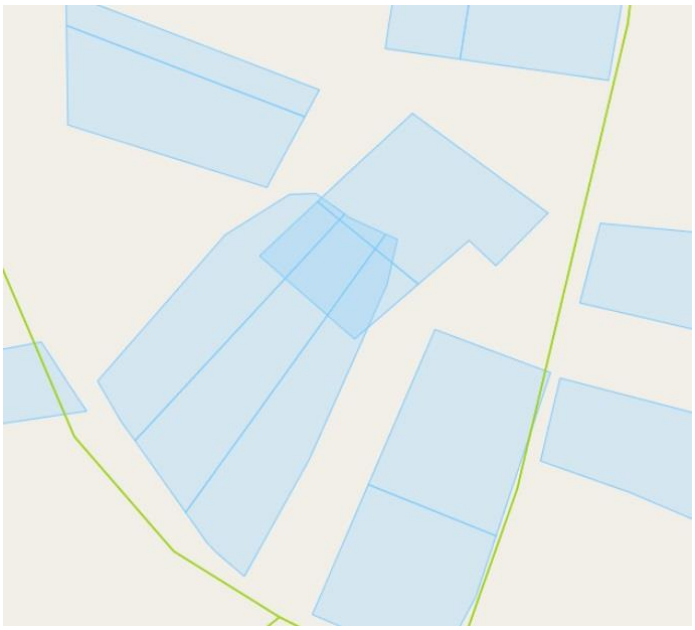

Fig. 1. "Multi-storey" land
Source: own research

What prevents the imposition of land? Information about a "multi-storey" land plot cannot be entered into the SLC. After all, paragraph 6 of Art. 24 of the Law establishes as one of the grounds for refusal to carry out the state registration of the land plot is finding within the limits of the land plot which is supposed to be registered, other land plot or its part. In this case, the owner will not be able to obtain the cadastral number required for the alienation of land. In addition, the cadastral number must be indicated in the contracts of sale, exchange, gift and mortgage agreements in order to identify the land. This means that in the absence of such a number, a person cannot fully dispose of the property - to sell, donate land or a building or other structure located on such a plot.

It should be noted that since 2013, there have been rules in Ukraine that allow for the correction of errors in the state land cadastre [7]. It should be borne in mind that the "clarification" of the spatial characteristics of land entails not only the adjustment of registration information on land, but also the re-issuance of "incorrect" title documents, clarification of land valuation, compensation to landowners and land users, and also bringing to justice persons who have previously incorrectly performed land management and topographic and geodetic works. Regarding the latter, according to the State Geocadastre, today there are 2927 business entities that perform topographic, geodetic and cartographic works, of which approximately 9% are at high risk; 27% - to the average; 64% - to a small degree of risk.

The owner of the land plot can choose between two ways out of the current situation:

1) re-register the ownership of a land plot of a smaller size or other configuration;

2) demand in court the recognition of their right to land in the amounts specified in the documents certifying the right of ownership of land, and in accordance with the plan of such land, which is contained in the state act on the right of ownership of land. The latter variant is chosen when the right to the plot is disputed or not recognized as the owner (user) of the neighboring (adjacent) land plot or the relevant authority.

Thus, the way out of this situation depends on the owners of specific land plots: whether one of them is ready to give in to another, or on the contrary there is no compromise between them - there is a dispute over the boundaries of land [8].

Nowadays, there are fewer and fewer new land allotments, because the land is not infinite, and, consequently, we have more and more problems with old allotments, old documentation, old cadastral information recorded in old documents. Often, newly established private agricultural enterprises use land without a proper legal basis, on the terms of lease of land shares (units), which are conditional land plots, the location and boundaries of which are not defined. Today, many citizens of Ukraine who in the manner prescribed by law received and registered before January 1, 2013 state acts on land ownership, still can not get an extract from the State Land Cadastre of land owned by them. At the same time, it should be noted that citizens have already paid significant funds for the development of land management documentation required to obtain state acts on land, which, incidentally, were also registered for a fee.

The negative consequences of the current registration system are especially noticeable when registering lease agreements for agricultural land, when the agreement concerns a large number of land plots (concluded simultaneously with a large number of land owners). According to statistics, the average cost of land rent in Ukraine in May 2015 was 727.6 UAH / ha per year. Currently, the country has concluded almost 4, 8 million land share lease agreements with a total area of more than 17 million hectares. In monetary terms, the annual rent for these operations is UAH 12 billion. And it is quite clear what financial resources can be used today in the land sector [9].

As a result, the state and local communities lose significant funds, as the level of rent for the lease of land without a tender is much lower than that which should be set at auction. It is also a wide field for abuse and corruption, as the transfer of land is opaque.

Here it is appropriate to cite the example when the Paris municipality in 1991, using a single geospatial database of Greater Paris, which was layered maps of property rights indicating the owners and purpose of all objects and land, switched to electronic management of territories.

As a result, by 1994, Paris's GDP had tripled.

It should be noted that during 2015 the Verkhovna Rada and the Cabinet of Ministers adopted a number of legislative innovations in the field of state registration of rights to agricultural land, including in the system of registration of agricultural land lease agreements [6, 7]. Among the advantages of such innovations are, first of all, the acceleration and simplification of the procedure for state registration of lease rights to agricultural land. This will allow citizens to choose to apply to the state registrar or notary, eliminate queues for registration of the above agreements, increase the efficiency of registration and quality of services by increasing competition and eliminate the corruption component for "speeding up the registration process". Therefore, the application for state registration of the lease of such a plot can be applied to both its owner and the acquirer of derivative rights (tenant) not only to the registration service of the territorial administration of justice, but also to notaries at the location of this real estate.

"Every year, according to citizens, about a million extracts are issued - this is the most popular service in the field of land relations. The workload on cadastral registrars is high and this has affected the level of service for citizens. Thanks to the connection of notaries to the State Land Cadastre, we reduce the pressure in the system and reach a new quality level of services in the field of land relations, "- said the Chairman of the State Geocadastre Maxym Martyniuk.

But unfortunately, this will do little to help vulnerable groups, who do not have the opportunity to search for organizations that developed technical documentation when they received state acts before January 1, 2013, and require the latter to convert the exchange file from in4 to XML format [10]. However, if the landowner does not have a copy of the technical land management documentation on the basis of which the state act on land ownership was obtained, the exchange file cannot be made without ordering new technical documentation, the cost of which is at least UAH 1,000.

This means that the state and local communities will continue to lose money. There is also room for abuse and corruption, as the procedure for renting land will be opaque without auctions. We can no longer allow land for "farming" for free or for a penny. This norm was intended for the development of small farming or for novice farmers. Instead, large agricultural holdings turn their employees into "farmers," negotiate with corrupt officials, and receive land for free.

Conclusions

Thus, modern transformations of land ownership and socio-economic structure of land use in the agricultural sector require final completion and legal consolidation. This makes it possible

to:

- first, to fill the State Land Cadastre with reliable information about land plots and provide relevant legal documents to interested persons;

- secondly, to fill the State budget with significant funds, which are so catastrophically lacking.

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EFFICIENCY OF GROWING OF TABLE BEET ROOTS USING DIFFERENT METHODS OF MULCHING IN THE CONDITIONS OF THE RIGHT-BANK FOREST-STEPPE OF UKRAINE

Summary

The article presents the research results on the impact of different methods of mulching the soil on the growth, development of table beet plants, root yields and their quality indicators in the Right-Bank Forest-Steppe of Ukraine.

Phenological observations, biometric and physiological-biochemical studies were performed according to the methods of G.L. Bondarenko, K.I. Yakovenko. The research material was the soil of the experimental field - typical leached black soil, low humus, medium loamy on forest-like loams. Bettolo F1 table beet hybrid was used as research objects, as well as various variants of mulch: black and transparent polyethylene film, agrofiber, sawdust and humus. The research was conducted in the research field of the Training and Production Center "Podillia" of State Agrarian and Engineering University in Podilia during 2016-2018.

The results of research show that the use of different methods of mulching seedlings with polyethylene film, agrofiber and local organic materials, contributes to the intensification of physiological and biochemical processes occurring in the plant of table beet. Mulching improves the agrophysical properties and nutrient regime of the soil, protects it from leaching and unproductive evaporation, promotes better aeration and permeability. The use of different methods of mulching crops contributes to the growth of the leaf surface of table beets by 4.3-5.8 thousand m^2 / ha, or 15.5-20.9%, respectively. The most favorable conditions for the formation of the maximum indicator of net productivity of photosynthesis have developed in the case of arable materials use (sawdust, humus).

It should be noted that under the influence of mulching the yield of table beet roots

increases by 4.7 t / ha, or 14.9%. The use of local organic materials (sawdust, humus) for mulching provided an increase in yield by 11.0-11.1 t / ha or 34.9-35.2% compared to the control. In addition, under the influence of crop mulching there is an increase in the share of marketable products, as well as improvement of biochemical and sanitary indicators of root crop quality, which is manifested in an increase in dry matter, sugars, vitamins and nitrates.

Further study and improvement should focus on in-depth study of innovative mulching methods using modern high-yielding varieties and hybrids of table beets.
Key words: table beet, hybrid, mulching, polyethylene film, humus

Introduction

The problem of climate change is extremely relevant today. The climate is changing quite rapidly and the factor is not only rising temperatures, but the restructuring of all geosystems. The effects of climate change are already evident. Regional manifestations of climate change are reflected in significant variability in temperature and precipitation, increasing intensity and recurrence of dangerous natural hydrometeorological phenomena, reducing the number and deterioration of drinking water, increasing the number of infectious diseases and allergies and more. Scientists' findings suggest that the ongoing climate change could lead to even more dangerous consequences in the future if humanity does not take appropriate precautions. Improving the culture of agriculture involves the introduction into production of measures that constitute its scientifically sound system [12]. Among them, soil mulching is important, which occupies a special place for a variety of beneficial effects on soil fertility and crop yields [3].

Mulching is an agrotechnical measure aimed at increasing yields and improving product quality. Covering the soil surface with organic or synthetic mulching materials reduces the evaporation of soil moisture, promotes the creation of close to the optimal temperature regime, affects the microbiological processes in the arable soil layer. All this has a positive effect on plant growth and development, accelerates ripening, increases yields and improves product quality [13].

Kovaliov N.G., Hailis G.A., Kovaliov M.M. note that mulching the soil limits the growth of weeds, thereby reducing the number of cultivations and labor costs [8].

The experience of the advanced countries of the world shows that highly productive vegetable growing is based on the achievements of scientific and technological progress, in particular due to mulching with modern mulching materials of organic and inorganic origin [4, 14].

In Bulgaria, mulching is widely used in the cultivation of vegetables and berries. In Japan,

organic materials are used, as well as black and transparent film. Mulching with film is carried out in the open ground on an area of 34 thousand hectares, in the middle of the film tunnel shelters - 33.5 thousand hectares and in greenhouses - 15.5 thousand hectares [6].

Scientific estimates of mulching on Ukrainian soils in this direction are almost non-existent, only research of mulching of non-irrigated soil together with sorbent (hydrogel) has been conducted in recent years in the Forest-Steppe on broccoli seeds, cucumbers, where the positive effect of mulching on reducing unproductive water consumption to depth root layer 50 cm [10].

Many years of experience in many countries around the world have proven the effectiveness of the use of mulching film in the cultivation of vegetable crops, which affects the water, air and temperature of the soil. In addition to warming up, the most important aspect of mulching technology is weed control. Due to local conditions, high temperatures may prevent weeds from growing in summer. Black film is most effective in weed control, it does not form mold. An additional effect of mulching with a film can be achieved due to the fact that the film retains moisture well in the top layer of soil [9].

When growing plants on film, there is an improvement in the quality of root crops, a reduction in the number of weeds, a reduction in moisture evaporation, a reduction in the weathering of fertilizers and a reduction in soil compaction [17].

Mulching the soil with agrofiber gives positive results [1]. The use of agrofiber prevents the development of weeds, which makes it possible to eliminate the use of herbicides and get environmentally friendly products. The effectiveness of mulching the soil with agrofiber is that the dark color attracts solar energy, thus creating a temperature for the root system of plants at which vegetables ripen earlier [11].

According to Ham J.M., Kluitenberg G.J., Lamont W.J., the use of mulching materials of inorganic origin helps maintain soil moisture and reduces the frequency of watering, inhibits the growth of weeds that compete with vegetable plants for water and nutrients [18].

Thus, according to the research of Bezvikonny P.V., Muliarchuk O.I. it is proved that organic mulching materials are actively mineralized during operation, the structure of the soil improves, its acidity changes and the content of nutrients in it increases. It should also be noted that the organic mulching material provides food to the soil microflora, which in the process of life releases carbon dioxide required for photosynthesis [2].

According to Sirina A.Yu., Izmailova O.A., the use of mulch of organic origin, improves the agrophysical properties of black soils, which is manifested in the improvement of structural and aggregate composition, reducing density and increasing porosity [15].

Therefore, the introduction of innovative mulching methods is relevant for the region,

which will ensure rational use of water reserves in the soil, improve soil biota, soil fertility, and in case of spring frosts will help preserve beet seedlings, increase root yields and significantly improve product quality.

Purpose, subject and methods of research

The purpose of the study is to study the influence of soil mulching methods on the growth, development of table beet plants, root crop yield and their quality indicators in the conditions of the Right-Bank Forest-Steppe of Ukraine.

Researches on the study of effective methods of mulching table beets were conducted during 2016-2018 in the research field of the Training and Production Center "Podillia" State Agrarian and Engineering University in Podilia

The soil of the experimental field is typical leached black soil, low-humus, medium loamy on loess-like loams. The content of humus (according to Tiurin) in the soil layer 0-30 cm is 3.6-4.2%. The content of easily hydrolyzed nitrogen compounds (according to Cornfield) is 90-127 mg / kg, mobile phosphorus (according to Chirikov) 138-174 mg / kg and exchangeable potassium (according to Chirikov) - 145-185 mg / kg of soil.

Agrotechnics of table beet cultivation is generally accepted for this zone and complied with SSTU 6014: 2008 “Table carrots and table beets. Growing technology". Predecessor is potato. The size of the sown area during cultivation for marketable products is 20 m^2, accounting - 15 m^2, the repetition of the experiment - four times. Bettolo F1 table beet hybrid was sown.

The experiment studied the variants of mulching the soil with black and transparent polyethylene film, agrofiber, sawdust and humus. The variant without mulching was chosen for control.

Mulching materials were spread on a flat soil surface immediately after germination. The consumption of mulch was when using sawdust - 6 t / ha, humus - 15 t / ha.

Phenological observations, biometric studies were performed according to the methods of G.L. Bondarenko, K.I. Yakovenko [5].

Research results

Phenological observations of the growth and development of Bettolo F1 table hybrid beet plants revealed differences depending on the method of mulching the soil of seedlings with mulching materials (Table 1).

Table. 1. The onset of phenological phases of growth and development of table beets depending on the methods of mulching (Bettolo F1 hybrid, average for 2016-2018)
Source: own research, research field of the Training and Production Center "Podillia" of State Agrarian and Engineering University in Podilia

Variants of research	Number of days				
	from sowing to mass germination	From mass seedlings to:			
		formation of the 1st pair of real leaves	formation of the 3rd pair of real leaves	beam ripeness	technical ripeness
Control (without mulch)	17	15	25	64	107
Transparent polyethylene film	15	12	22	59	104
Black polyethylene film	15	12	21	54	102
Agrofiber	15	11	20	53	101
Sawdust	15	11	20	53	101
Humus	15	11	20	52	100

The emergence of seedlings in the control variant was observed on the 17th day after sowing, and in the variants where mulching was used - on the 15th day. The formation of the first pair of real leaves during mulching of the soil with a transparent and black polyethylene film was ahead of the control by 3 days, and by humus, sawdust and agrofiber by 4 days. This pattern persisted with the onset of formation phase of the 3rd pair of real leaves and beam ripeness. In the first case, the lead was 3-5 days, in the second - 4-10 days. The onset of technical ripeness of the roots of the Bettolo F1 hybrid in the variants with mulching of seedlings was noted after 100-104 days, in the control - 107 days after mass germination.

Thus, the use of mulching crops with organic and inorganic materials has a positive effect on reducing the duration of the growing season of table beets. The use of inorganic materials promotes faster onset of technical ripeness, namely 3-6 days earlier, and mulching with organic materials - 6-7 days, respectively.

The growth of the assimilation surface of beet leaves was as follows (Table 2).

In the phase of mass germination, the area of leaves in all variants was 0.2 dm^2, at the beginning of root formation (June 12-13) variants with mulching of seedlings with organic materials formed an average of 1 plant per 35.7 - 36.0 dm^2 against 29.7 dm^2 in control. In the phase of technical ripeness of root crops, this indicator was 80.9-81.2 dm^2 and 68.9 dm^2, respectively.

Table. 2. Formation dynamics of beet leaves area depending on the methods of mulching (dm^2 / plant, average for 2016-2018)
Source: own research, research field of the Training and Production Center "Podillia" of State Agrarian and Engineering University in Podilia

Variants of research	mass seedlings	beginning of root formation	technical ripeness
Control (without mulch)	0,2	29,7	68,9
Transparent polyethylene film	0,2	33,1	72,4
Black polyethylene film	0,2	34,2	73,6
Agrofiber	0,2	35,6	80,8
Sawdust	0,2	35,7	80,9
Humus	0,2	36,0	81,2

This increase in the growth of the assimilation surface is due, in our opinion, to the fact that the use of mulching seedlings with organic materials (sawdust, humus) optimizes the physical properties of the soil, improves water, air and gas, and nutrient regime, while plants grow better .

In the research of the Institute of Bioenergy Crops and Sugar Beets of NAAS of Ukraine, the development of beet leaf apparatus was considered in terms of such factors as beet variety, plant density, mineral fertilizers and the use of bentonites. The results of research have shown that the level of mineral nutrition significantly affects the growth and development of sugar beet leaves throughout the growing season. The best development of leaves both in terms of their number and area was shown by variants with application of 5-15 t / ha of bentonites on the background of $N_{90}P_{120}K_{90}$. It was also found that the application of bentonites in pure form gives a positive effect, and the introduction of bentonites (7-15 t / ha) and mineral fertilizers, the maximum development of the leaf apparatus of beets is observed [7].

In studies conducted in the research field of Vinnytsia National Agrarian University, the use of polyethylene film and the use of agricultural ores for crops contributed to the formation of a more powerful assimilation apparatus of plants and increase yields [16].

Determination of leaf area showed that during the period of intensive root growth in the phase of closing the rows in the control variant, the total leaf area was 27.8 thousand / m^2 (Table 3).

Table. 3. The area of beet leaves depending on the methods of mulching in the phase of closing the rows (average for 2016-2018)
Source: own research, research field of the Training and Production Center "Podillia" of State Agrarian and Engineering University in Podilia

Variants of research	Total area of leaves, thousand / m^2
Control (without mulch)	27,8
Transparent polyethylene film	32,1
Black polyethylene film	32,7
Agrofiber	33,2
Sawdust	33,4
Humus	33,6

The use of transparent and black polyethylene film contributed to the growth of this indicator by 15.5-17.6%. When mulching crops with organic materials (sawdust, humus), the value of the assimilation surface of beets increased by 20.1-20.9%. The use of agrofiber as mulch also contributed to the increase in leaf area, but to a lesser extent - by 19.4%.

Thus, the use of mulching seedlings with synthetic and local organic materials contributes to the formation of a larger assimilation apparatus, which has a positive effect on the photosynthetic activity of table beet plants.

Mulching improves the agrophysical properties and nutrient regime of the soil, protects it from leaching and unproductive evaporation, promotes better aeration and permeability. In addition, the process of mineralization of organic minerals is accompanied by the release of carbon dioxide and, as a consequence, more intensive photosynthesis. Thus, the use of different methods of mulching crops contributes to the growth of the leaf surface of table beets by 4.3-5.8 thousand m^2 / ha, or 15.5-20.9%, respectively.

In the areas using mulch, table beet plants accumulated more intensively both raw and completely dry mass, as a result of which the indicators of photosynthesis net productivity were higher than in the plants in the control variant (Table 4).

The period "beginning of root formation-technical ripeness" was characterized by the largest accumulation of biomass in table beet plants compared to the previous period. Based on this, the productivity of photosynthesis increased - 2.7-3.0 g / m^2 × day, depending on different methods of mulching. The use of polyethylene film provided an increase in photosynthesis net productivity by 8% in the case of agrofiber by 12%.

Table. 4. Photosynthesis net productivity of table beets depending on the methods of mulching, g / m^2 × day (Bettolo F1 hybrid, average for 2016-2018)
Source: own research, research field of the Training and Production Center "Podillia" of State Agrarian and Engineering University in Podilia

Variants of research	Phases of development		
	mass seedlings	seedlings-the beginning of root formation	the beginning of root formation-technical ripeness
Control (without mulch)	0,3	1,9	2,5
Transparent polyethylene film	0,3	2,2	2,7
Black polyethylene film	0,3	2,3	2,7
Agrofiber	0,3	2,6	2,8
Sawdust	0,3	2,6	2,9
Humus	0,3	2,6	3,0

The most favorable conditions for the formation of the maximum indicator of photosynthesis net productivity have developed in the case of arable materials use (sawdust, humus). In the period "beginning of root formation-technical ripeness" the productivity of photosynthesis in this case was 2.9-3.0 g / m^2 × day, which is 16-20% higher than the control.

In areas with the use of transparent and black polyethylene film, the yield of root crops increased, depending on weather conditions during the study period for an average of three years - by 4.7 and 6.2 t / ha or 14.9 and 19.7% (Table 5).

Table. 5. Yields of beet roots of table hybrid Bettolo F1 depending on the methods of mulching, t / ha
Source: own research, research field of the Training and Production Center "Podillia" of State Agrarian and Engineering University in Podilia

Variants of research	Years			Average for 2016-2018	± before control	
	2016	2017	2018		t/ha	%
Control (without mulch)	32,5	32,9	29,1	31,5	-	-
Transparent polyethylene film	37,6	36,5	34,5	36,2	4,7	14,9
Black polyethylene film	38,8	38,9	35,4	37,7	6,2	19,7
Agrofiber	44,6	42,2	40,1	42,3	10,8	34,3
Sawdust	42,5	44,6	40,4	42,5	11,0	34,9
Humus	43,5	43,5	40,8	42,6	11,1	35,2
$LSD_{0,5}$	2,8	4,1	3,9	-		

Under the influence of mulching seedlings with agrofiber, the increase in yield reached 10.8 t / ha (or 34.3% above control). The use of local organic materials (sawdust, humus) for mulching provided an increase in yield by 34.9-35.2% to control. This increase in crop productivity was due to the improvement of soil nutrition and its agrophysical properties, acceleration of plant growth and development, as well as better photosynthetic activity of beets in crops.

On the average for years of researches the weight of root crops on control has made 196 g

(tab. 6). In the variants where seedling mulching was performed, on average over three years of research, table beet plants formed roots with a higher weight compared to the control. The largest weight of roots was obtained when using humus as mulch 215 g, which is 9.7% higher than control. The use of transparent polyethylene film contributed to the growth of root weight by 12 g, or 6.1%, and mulching with black polyethylene film provided an increase of 14 g, or 7.1%.

Table. 6. Weight and marketability of root crops, the average for 2016-2018
Source: own research, research field of the Training and Production Center "Podillia" of State Agrarian and Engineering University in Podilia

Variants of research	Weight of root crops	± before control		Yield of standard products,%	± before control
		г.	%		
Control (without mulch)	196			84,1	
Transparent polyethylene film	208	12	6,1	87,2	+3,1
Black polyethylene film	210	14	7,1	88,7	+4,6
Agrofiber	211	15	7,7	91,0	+6,9
Sawdust	213	17	8,7	90,8	+6,7
Humus	215	19	9,7	91,3	+7,2
LSD0,5	11	-	-	-	-

In our studies, we found a high yield of standard roots of table beets, which was 84.1% in control. The use of mulch of organic and inorganic origin contributed to the growth of marketability to 87.2-91.3%, or 3.1-7.2%.

In the course of research we found that mulching crops had a positive effect on the biochemical composition of beet roots (Table 7).

Table. 7. Influence of greening and mulching of seedlings on biochemical parameters of table beet roots (Bettolo F1 hybrid, average for 2016-2018)
Source: own research, research field of the Training and Production Center "Podillia" of State Agrarian and Engineering University in Podilia

Variants of research	Content in root crops:			
	dry matter, %	general sugar, %	vitamin C, мг%	nitrates, mg / kg
Control (without mulch)	16,2	11,3	15,0	823
Transparent polyethylene film	17,3	12,2	16,0	786
Black polyethylene film	17,7	12,6	16,3	781
Agrofiber	18,1	13,1	16,7	768
Sawdust	18,0	13,1	16,8	762

Humus	18,3	13,2	17,0	773
LSD0,5	1,1	0,9	1,0	41

The dry matter and sugar content in the control variant was 16.2% and 11.3%, when using inorganic mulch - 17.3-18.1% and 12.2-13.1%, and when using organic mulch – 18.0-18.3 and 13.1-13.2%, respectively. The amount of ascorbic acid also increased from 15.0 to 16.0-17 mg%. It should be noted that for all these quality indicators was the best variant with the use of humus as mulch.

Our studies also showed a significant decrease in the content of nitrates in roots to 762-786 against 823 mg / kg in the control (MDR = 1500). A significant reduction in the content of nitrates (by 61 mg / kg) occurs in the variant with the use of sawdust as mulch, which is primarily due to its sorption capacity.

Conclusions

Thus, the use of different methods of mulching seedlings, polyethylene film, agrofiber and local organic materials, contributes to the intensification of physiological and biochemical processes occurring in the plant beet. Mulching improves the agrophysical properties and nutrient regime of the soil, protects it from leaching and unproductive evaporation, promotes better aeration and permeability. The use of different methods of mulching crops contributes to the growth of the leaf surface of table beets by 4.3-5.8 thousand m^2 / ha, or 15.5-20.9%, respectively. The most favorable conditions for the formation of the maximum indicator of photosynthesis net productivity have developed in the case of the use of arable materials (sawdust, humus).

It should be noted that under the influence of mulching the yield of table beet roots increases by 4.7 t / ha, or 14.9%. The use of local organic materials (sawdust, humus) for mulching provided an increase in yield by 11.0-11.1 t / ha or 34.9-35.2% compared to the control. In addition, under the influence of crop mulching there is an increase in the share of marketable products, as well as improvement of biochemical and sanitary indicators of root crop quality, which is manifested in an increase in dry matter, sugars, vitamins and nitrates.

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DEVELOPMENT OF TECHNOLOGY ELEMENTS TO IMPROVE FISH PLANTING MATERIAL

Summary

A significant number of studies indicate that when growing fish in aquaculture there are cases of carcinogenesis, caused by the presence in feed of aflatoxin, which is produced by fungi. This fungi commonly found in nature that can affect forage fish careless storage. Experimentally proved that the presence of 1 kg of aflatoxin in the ton of feed for 20 months feeding leads to disease trout hepatoma (liver tumor). The study is based on a set of rules and procedures contains a series of methods to use. These methods include: Processing vmtime intestinal tract of the fish was carried out according to the standard technique. Vmtime digestive tract of fingerling was saguaros on torsina weight. For analysis were taken 10 fish groups. At the opening of the intestine differed in the border that divided artificial from natural food. The first was always bright colors. The second had the appearance of a dark brown mass, which consisted of sludge, organisms of the plankton and benthos. The result of the developed methodology is the calculation of the density of producers so that each female had at least 8, the male – 6 m2 area of the pond. The producers start feeding at 12°C. a mixture of 40-50% of waste grain, wheat bran 5-10, 20-30 per meal and meals, to 10 flour legumes, 5-10 sprouted grains, 5% vitamin flour. The volume of the diet at first did not exceed 1% of the mass producers. Then, depending on temperature and hydrochemical regime of the water specified quantity of feed has increased to 2-3 %. If after 10 hours of feed DaVinci found his remains, the amount of diet was reduced. Before spawning manufacturers treated with the antiparasitic baths with the following content them under running clean water .To prevent the development and accumulation in spawning ponds of pests and enemies of young fish, pathogens invasive diseases, ponds filled with water not earlier than 12-14 hours before planting to spawn producers, water nagrik ponds or septic tanks. Gaining water through filters in heating

the ponds a few days before boarding the spawning carp. The area of the spawning ponds of the farm is 11 hectares they had planted 14 sockets manufacturers. Manufacturers of carp planted in a spawning night, in calm and warm weather, when water temperature was equal to 18ºC, the following morning manufacturers are beginning to lay eggs. Spawning takes place in shallow waters that are well warmed up. Carp males actively pursuing females, splashout fins and iplehouse out of the water, the females at this time allocate eggs that is within 1-2 minutes fertilized by the sperm of males.

Key words: fish, planting material, fungi

Introduction

The current state of the vast majority of fisheries enterprises in Ukraine is characterized by a decrease in production. The decline in production is largely caused by a set of interrelated socio-economic factors of a limiting nature, which arose during the transition to market relations.

In the current situation, there is a need to identify reserves for the development of the industry, in particular, the search for non-traditional approaches to fisheries, aimed at improving productivity, efficiency and profitability of production. In this regard, an important role belongs to the introduction of resource-saving environmentally friendly technologies, with a significant increase in the efficiency of natural biological resources of water bodies with the use of optimal multiculture of fish. The key task for modern fish farming is to provide fish farms with the necessary amount of quality fish planting material of valuable aquaculture facilities. It is impossible to solve this problem without increasing the number and improving the quality of breeding material of cultivated fish species [1,7].

The choice of fish farming technology in ponds under modern conditions is dictated by the laws of a market economy. Most fish farms grow fish using grazing technology, which, of course, is characterized by a significant reduction in its production [5,6]. Significantly larger reserves of fish stock production are laid in intensive technology using the optimal set of fish farming facilities of different trophic levels, as well as intensification measures. To achieve high rates of commercial fish farming, first of all, it is necessary to pay attention to the cultivation of quality planting material in growing ponds. Among a number of factors influencing the growth of fish and the quality of fish planting material, we should highlight the environmental conditions, the development of natural feed base and consumption of feed organisms in ponds [2,4,8,].

Analysis of the technology of growing fish planting material. Analysis of recent research and publications Selection and selection of broodstock by genetic and zootechnical indicators,

aimed at the formation of herds, creating optimal conditions for their cultivation. The broodstock is kept separate from the repair young, females separately from the males at low planting density. Breeding and inventory of repair and breeding stock, as well as culling is carried out by fish breeders-breeders [1,3,8].

Particular attention is paid to the prevention of fish diseases during non-growth, because during this period, with a significant concentration of young and the presence of broodstock in the ponds, favorable conditions for the spread of infectious diseases. In this regard, the creation of zoohygienic and ecological conditions for spawning and rearing of larvae in the spawning ponds, the formation of a suitable plant substrate from moisture-resistant grasses is a priority.

To prevent the development and accumulation in spawning ponds of pests and enemies of young fish, pathogens of invasive diseases, ponds are filled with water no earlier than 12-14 hours before planting broodstock for spawning. Otherwise, frogs, shield bugs, water bugs and other invertebrate fauna will appear in spawning ponds, which not only destroy larvae and fry, but are also direct competitors in the diet of young. In the early stages of life, malnutrition of young people negatively affects their physiological condition, reduces the body's resistance to disease, leads to increased mortality. In spawning ponds it is necessary to create conditions for the development of a sufficient amount of natural feed [7,8].

Purpose, subject and methods of research

The objects of research were larvae and yearlings of Ukrainian scaly carp in the process of growing them in spawning and rearing ponds. Complete parasitological autopsies of fish, as well as clinical observations of them were carried out according to conventional methods. In total, about 200 specimens of fish were examined. This took into account the hydrochemical and hydrobiological regime of ponds and fish farming measures, which were carried out for many years.

To determine changes in the parasitofauna of pond fish depending on the habitat, step-by-step surveys of this year and fish data, planting density, fish feeding, and pond fertilization were taken into account.

During the vegetation period in the experimental ponds were studied: temperature and hydrochemical conditions, natural forage base (zooplankton, phytoplankton, zoobenthos) of fish.

Processing of the intestinal tract of fish was carried out according to the generally accepted method [4]. The capacity of the food tract this year was weighed on a torsional weight. 10 fish from the groups were selected for analysis. At opening of intestines the border which separated

an artificial forage from natural differed. The first was always light in color. The second had the appearance of a dark brown mass, which consisted of silt, plankton and benthos.

Research results

After the ice melts, water is drained from the winter ponds and fish are caught from them, and the winter-uterine ponds are unloaded at a water temperature of 9-10°C. Before spawning, an inventory of uterine livestock is carried out, distributed by sex and planted in different reservoirs. Pre-spawning of broods lasted 25 days. Appropriately prepared gardens and pre-spawning ponds are used for pre-spawning maintenance.

All spring work with fruiting bodies is performed with special care. The broods are taken by the sleeve and carried in a tarpaulin stretcher filled with water, covered with a net or a tarpaulin apron. No more than two females or three males are placed in one stretcher.

Planting density of broodstock is calculated so that each female had at least 8, the male - 6 m² of pond area. Feeding of broodstock begins at a temperature of 12°C. Use a mixture of 40-50% of grain waste, 5-10 wheat bran, 20-30 meal and meal, up to 10 flour of legumes, 5-10 germinated grain, 5% of vitamin flour. The volume of the diet at first did not exceed 1% of the weight of the offspring. Then, depending on the temperature and hydrochemical regime of the water, the amount of the given feed was increased to 2-3%. If 10 hours after the feed was found, its remains were found, the volume of the diet was reduced.

Before spawning broods are treated in antiparasitic baths with their subsequent content in running clean water. To prevent the development and accumulation in spawning ponds of pests and enemies of young fish, pathogens of invasive diseases, ponds are filled with water no earlier than 12-14 hours before planting broodstock for spawning, with water from heating ponds or settling tanks. Water is collected through filters in heating ponds a few days before planting carp to spawn.

The area of spawning ponds on the farm is 11 hectares. 14 nests of broodstock were planted in them. Carp broods are planted for spawning in the evening, in quiet and warm weather, when the water temperature was 18ºC, in the morning of the next day the broodstock begins to lay eggs. Spawning occurs in shallow water, which is well warmed. Male carp actively chase females, splashing swimmers and floating out of the water females at this time secrete eggs, which are fertilized for 1-2 minutes by male sperm.

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The concentration of dissolved organic matter was in the range of 9.4-10.2 mg O / l. The concentration of ammonium nitrogen, nitrite and nitrate compounds in the water of the ponds was within the fish standards. There were no significant differences between these indicators during the study period. The concentration of mineral phosphorus fluctuated during the period of fish farming from 0.01 to 0.18 mg R / l. The total mineralization of pond water was at the level of 367.8 - 469.4 mg / l.

At a water temperature of 21-23ºC, hatching of the larva began after 3 days, ie after 66 degrees (22 × 3), or 1584 degrees. After hatching, the larvae were not motile and with the help of an adhesive were attached to the plants. The larvae were fed by the yolk sac. On the third or fourth day, the larvae began to move actively and feed on small zooplankton.

Catching spawning ponds begin on day 4-5 of active feeding of carp fry, ie 7-8 days after hatching from caviar. Carp larvae are caught directly from the spawning pond and outside it in the drainage channel. The catch is carried out with gauze rags or nets with a diameter of 40-50 cm. places-channels. To prevent the fry from coming out with the water, a small (1-1.5 mm) lattice (wooden frame covered with gauze) is installed in front of the shields in the walls of the water outlet.

The fry are counted roughly. The fry are scooped into small bowls or buckets and counted. This is done several times, trying to ensure that the density in the vessel was the same and then accurately determined by the number of fry. The yield of one female was 150-160 thousand larvae. Fry from spawning to rearing ponds are transported in stretchers and metal cans.

Of great importance in the process of growing fish planting material is the preparation of growing ponds, which begin in the fall. Immediately after the catch, the fish-collecting ditches are cleared, completely drained for the winter, acidic wetlands are limed, and slaked lime is disinfected - 10-15 c / ha. Hydraulic structures are being repaired. In the spring, as soon as the soil

has thawed by 7-10 cm, very overgrown shallow areas are cleared by a bulldozer. The bed of ponds is treated with a cultivator with loosening of the surface layer of soil.

Filling the pond begins 8 days before planting larvae. First, fill its deep-water part (50-60% of the area), then gradually, step by step fill the entire pond to the design mark in order to ensure the development of zooplankton for a long period. Group fish-catch filters of envelope type are installed on water supply channels and water inlets are equipped with individual garbage protection from a metal grid. The filters are controlled, their integrity is regularly checked in the morning and in the evening, garbage and fish caught in the filters are removed from them.

The most common is the system of growing carp this year, in which its larvae are planted directly from the spawning ground for cultivation in growing ponds. Juveniles are released into the pond carefully from buckets along the air side of the shoreline in several places, especially where clusters of zooplankton have been observed. Transplanted larvae from spawners in breeding ponds in the morning before sunrise. The stocking density of the growing pond was 100 thousand specimens / ha. The yield of this year from the cultivation pond was 50%, fish productivity of ponds was 1400 kg / ha. Reclamation measures and fertilization of ponds contribute to the increase of natural fodder base stocks. Pond fertilizers were applied with organic and mineral fertilizers during the growing season.

Table. 1. Approximate schedule of fertilizer application, kg / ha
Source: own research

Date	phosphate	Ammonium nitrate
12.05	65	55
12.06	45	35
12.07	25	25
12.08	25	25
Total	160	140

Efore the start of the growing season, organic fertilizers (manure) of 2 t / ha were applied to the bed of the growing pond. The application of organic and mineral fertilizers in growing ponds stimulated the formation of primary products by providing plants with mineral nutrients, which are lacking, mainly nitrogen and phosphorus. In crop production, fertilizers act directly on the crop being grown, and in reservoirs, they ensure the development of the first link in the trophic chain - algae. Phytoplankton is food for zooplankton and benthos.

The average monthly water temperature in the ponds during the growing season ranged from 14.4 to 21.6 ºC - in May, 16.5 - 25.5 - in June, 22.6 - 26.5 - in July, 20.2 - 24 , 5 in August

and 15.5 - 17.8 in September.

According to the results of chemical analyzes, the water of the ponds according to the main indicators corresponded to the hydrochemical standards for the cultivation of fish planting material. The average seasonal concentration of dissolved oxygen in the water during the season was in the range of 3.6-7.4 mg / l O2. The value of the hydrogen index (pH) of water ranged from 6.0 to 8.2 units. The concentration of nitrogen compounds in water was stable and insignificant with some increase at the end of the season 0.02-0.66 mgN / l. The amount of mineral phosphorus averaged 0.06-0.35 mg R / l. Permanganate on the oxidation of the aqueous medium ranged from 8.2 to 25.2 mg O / l. The water of the ponds was of average mineralization with the sum of ions 356.5-567.5 mg / l, the ionic composition it belonged to the hydrocarbonate class of the calcium group of the second type (table 2).

Table. 2. Indicators of the hydrochemical regime of the experimental pond
Source: own research

Indexes	MPC OST 15.372 – 87	May	July	September
Temperature ºC	—	18,0	24,6	16,7
O2, мг/л	6 – 8	7,4	3,6	5,4
pH	6,5 – 8,5	8,2	6,4	6,0
NH4+,мг N/л	до 1,0	0,02	0,4	0,7
$PO4^{3-}$	до 0,5	0,06	0,2	0,3
Oxidation is permanganate, мг O/л	до 15	8,2	25,2	16,4
Total mineralization, mg / l	300 – 1000	356,5	567,5	424,2

Zooplankton of the experimental pond was formed due to three main groups of organisms: rotifers, branched-headed and oars-legged crustaceans, and on average during the season its biomass in the growing pond was at the level of 7.9-18.5 g / m³. Zoobenthos was dominated by chironomid larvae and oligochaetes, their average seasonal biomass in the pond was in the range of 1.6-4.5 g / m². The average seasonal biomass of phytoplankton was at the level of optimal values - close to 20-35 g / m³.

Feeding of yearlings in experimental ponds begins 3 weeks after stocking of growing ponds, when the water level in them has reached the design mark.

Intensive feeding of young begins in late June - early July after the fry reach an average weight of 3 g. The estimated total weight of feed by months is distributed as follows:%: June - 15,

July - 25, August - 35, September - 20, October - 5. A certain amount of feed per month is distributed over decades and every day. Number of feedings - 6-7 times a week, 1-2 times a day. Compound feeds with a protein content of at least 30% are used for growing this year. The daily norm for intensive feeding depends on the protein content in the feed, the average weight of young, water temperature and zooplankton biomass.

Table. 3. Daily norm of compound feeds with protein content of 30% and above for this year carp (% of body weight of fish)
Source: own research

Temperature water, ºC	The average weight of this year's carp, g							
	3	5	7	10	15	20	25	30 і>
12	2,3	2,2	2,1	2,1	2,0	1,9	1,9	1,9
15	3,5	3,4	3,2	3,1	2,9	2,8	2,7	2,6
18	5,3	5,0	4,8	4,5	4,3	4,1	4,0	3,9
21	7,1	6,7	6,3	6,0	5,7	5,5	5,3	5,2
24	9,2	8,6	8,2	7,8	7,4	7,1	6,9	6,7
26 and above	10,7	10,0	9,6	9,2	8,6	8,3	8,0	7,9

Feeding of this year in a growing pond was carried out at the same time twice during the light part of the day. The first feeding was performed from 8 o'clock in the morning after determining the water temperature and the content of dissolved oxygen in it. Fodder was fed on fodder sites 3-4 m in size, one site for 8-10 thousand this year. The intensity of feeding was adjusted depending on water temperature and oxygen content. K - 2 compound feeds were used for feeding this year.

Table. 4. Compound feed recipes for this year carp,%
Source: own research

Інгредієнт	К – 2
Fish flour	10
Bone meat	0
Herbal	3
Wheat	15
Sunflower meal	30
Pea	10
Barley	32
Together	100

The timing of fishing is determined depending on climatic and weather conditions. The dependence of fish farming on weather conditions leads to the need to catch fish in the shortest

possible time. For the correct organization of a catch make schedules, complete fishing crews, prepare for descent of a pond and fish stock (seines, delusions, stretchers, buckets, containers for transportation, scales, vehicles). Preparatory work should be completed 10-15 days before the catch. In the experimental ponds, fish were caught with the help of fish catchers and in a fish collection pit before the bottom water outlet. Water from the ponds was drained gradually, replacing the shields with grates, which were regularly cleaned of debris.

Table. 5. Morphometric parameters of this year carp
Source: own research

Indexes	This year from a growing pond
Mass, g	28
Length, cm	10,1
Fattening factor	2,7

In the study of fishpond indicators, it was found that the area of growing ponds was 21 hectares, in which 2,100,000 specimens were planted. carp. The percentage of yield from growing ponds was 50%. The total weight of fish caught from the pond was 29,400 kg, with a productivity of 1,400 kg per hectare.

Conclusions

1. In the study of the hydrochemical regime of ponds it was found that all indicators were within normal limits during the growing season. Zooplankton ponds were formed due to three main groups of organisms: rotifers, branched-headed and paddle-legged crustaceans. Its biomass in growing ponds was at the level of 7.9-18.5 g / m². Zoobenthos was dominated by chironomid larvae and oligochaetes, their average seasonal biomass in ponds was in the range of 1.6-4.5 g/m². The average seasonal biomass of phytoplankton was at the level of optimal values - close to 20-35 g / m³.
2. For the cultivation of fish planting material used growing ponds, which were planted 100 thousand specimens / ha.
3. During the growing season, organic and mineral fertilizers were applied. Young fish were fed K - 2 compound feed with a protein content of 30%.
4. In the study of fishpond indicators, it was found that the area of growing ponds was 21 hectares, in which 2,100,000 specimens were planted. carp. The percentage of yield from growing ponds was 50%. The total weight of fish caught from the pond was 29,400 kg, with

a productivity of 1,400 kg per hectare.

5. The application of intensification measures, namely: application of fertilizers, reclamation and feeding of fish cause an increase in fish productivity of ponds and profitability of production.

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COMPETENCE OF THE RESEARCHER IN SEARCH OF THE OPTIMAL PLACE FOR WHEAT TRITICUM SPELTA IN ORGANIC CROP ROTATION

Summary

Due to the popularization of organic lifestyle, the demand for organic products is growing in the world in general and in Ukraine in particular, and the study of conditions for creating highly productive organic agrocenoses is an important element in increasing production of popular products.

The article presents arguments concerning crop rotation as an effective tool for ensuring stable crop yields, preservation and restoration of soil fertility, natural control over the spread of diseases and pests in the agro-ecosystem.

Applying the method of critical analysis of scientific and methodological literature, based on the experience of foreign researchers and the work of Ukrainian producers of organic raw materials simulated variants for placing spelled wheat in organic short-rotation grain-grass crop rotations and long-rotation grain-grass, moderately rich in legumes and forage crops rotations, where winter spelt is desirable to place after the grain of legumes, legumes, and sometimes cereals, always taking into account the moderate demands of the crop to nitrogen nutrition and purpose of the grain grown.

To control the spread of pests, diseases and weeds, the maximum grain saturation of crop rotations in organic production should not exceed 50%.

Key words: spelt wheat, crop rotation, organic system, predecessors, organic products, crop rotation groups, organic farming

Introduction

The wheat growing area of Triticum spelta stretches from Canada to Kazakhstan, from Argentina to Australia [2]. According to data (FIBL, 2013), the total volume of crops of this crop in 2013 was 1.2 million hectares, which is 0.8 million hectares more than in 2004. The largest producers of spelt are China, Turkey and Italy. Since 2012, Ukraine has also increased the production of organic products and in 2018-2020 Ukrainian producers imported to Europe about 200 thousand tons of organic wheat (durum wheat and spelt together).

Spelt cultivation in the world is most often carried out in organic production [19], where globally the percentage of spelt grain production in 2018-2020 was 42 and 36%, respectively, the top three crops are closed by oats and corn. This trend has been observed since 1990, when organic wheat took a leading place in organic systems [13]. High, compared to other cereals, yields, relatively high purchase prices (~ 8500 euros / ton) and ecological plasticity of wheat (Triticum spelta) allowed to make the crop universal. The wide spread of spelt in organic production is also facilitated by the variety of standards, rules and policies in the field of organic agriculture in different countries.

Purpose, subject and methods of research

The purpose of our research was to establish the best variants for crop rotation in organic agrocenoses to achieve effective control of pests and diseases, weed populations and regulation of wheat plant nutrition.

The subject of research is wheat Triticum spelta in organic crop rotation.

Based on the materials of observations and the method of critical analysis of scientific and methodological literature, the practical experience of foreign researchers and Ukrainian practitioners is studied, the variants of optimal placement of spelt wheat in organic crop rotations are modeled.

Research results

One of the important aspects of the spread of agricultural crops is its place in crop rotation. The importance of crop rotation in the cultivation of crops was known in the late nineteenth century, when it was established that wheat on wheat should be grown in the same field after a three-year break, in extreme cases the frequency should not exceed 4 times in 10 years [5]. According to the recommendations of the Swiss-Ukrainian project "Development of the organic

market in Ukraine" [3], when growing organic wheat to avoid diseases and weeds in crop rotation should follow the usual rules and pauses. The share of cereals should not exceed 50% of the total area of crop rotation. However, in different soil and climatic conditions, the share of individual crops may differ, which is typical for enterprises with different specialization of production.

Concentrations of wheat in traditional and organic agriculture, even in particularly favorable soil and climatic conditions for culture, are very different (Table 1).

Table. 1. World areas of organic wheat and spelt and the percentage of grain crops in the structure of organic crop rotations for the period 2018-2020
Source: [10]

Country	From an area of 1000 hectares		Percentage of area under organic crops (2018)				
	organic wheat	organic spelt	wheat	barley	oats	rye	all crops
Argentina	13,6		0,4	0,0	0,4	0,2	2,3
Austria	30,0	7,9	10,3	5,9	30,4	34,3	19,4
Canada	96,4	2,8	0,8	1,6	14,1	8,4	1,3
Czech Republic	8,9		1,1	0,9	10,8	7,8	11,2
Denmark	9,7		1,3	2,2	26,6	12,7	6,4
Finland	6,6		2,8	1,1	7,1	15,4	9,0
France	47,5	4,4	1,0	1,0	9,9	19,2	3,9
Germany	53,6	20,0	1,7	1,4	17,5	7,6	6,4
Greece	20,3		1,4	4,9	9,1	10,5	4,6
Hungary	13,4		1,4	0,5	2,3	2,4	3,1
Italy	111,9		5,2	11,9	17,2	6,3	10,3
Kazakhstan	81,9	0,8	0,8	0,3	1,1	0,0	0,1
Lithuania	12,8		2,2	1,9	24,2	28,5	5,7
Poland	9,7		0,4	0,3	3,5	3,6	4,3
Romania	46,2		2,8	1,8	0,8	3,8	2,1
Slovakia	6,7		1,8	1,3	14,6	14,5	8,3
Spain	41,6		2,2	2,0	9,3	4,7	6,4
Sweden	27,2		7,4	5,7	16,4	9,6	16,3
Turkey	128,9		1,7	0,9	1,4	0,9	1,9

Ukraine	56,6	1,8	1,0	0,8	1,0	2,4	1,0
United Kingdom	17,6		0,6	1,6	9,4	69,1	3,3
USA	151,0	4,8	0,7	2,0	5,9	8,7	0,6

According to information (Stephan, 2015), in Northern Germany, where the yield of winter cereals is regularly 11 t / ha, the share of wheat among other cereals is about 70%, which leads to the sowing of wheat on wheat [6]. A similar practice can be observed in Ukraine as well, in PE "Agroecology" in Poltava region, eight-field field crop rotation by 30-35% is formed from winter grain [1]. In organic production in Germany, winter wheat is grown on 25.7% of the area of organic grain. This representation of culture in organic crop rotations is observed in other European countries: France, Spain, Switzerland (FiBL, 2015) [11].

Failure to comply with the minimum period of return of winter wheat in crop rotation causes a range of problems with plant protection. The population of weeds is growing significantly, such as Aventa fatua (Aventa fatua L.), Alopecurus myosuroides, and Bromus arvensis L.

Recent microbiological studies by Polish scientists [14] show that in monoculture the bases of the stems of winter wheat plants are much more likely to be affected by fungal diseases than in organic and conventional field crop rotations. In addition, shortening the wheat return period can lead to a problematic increase in the population of soil pests, the Hesse fly (Mayetiola destructor) [18]. The incidence of fungal diseases such as Gaeumannomyces graminis var. tritici, Tapesia yallundae, Fusarium spp. and Pyrenophora tritici-repentis [15]. Even in short-rotation crop rotations, when winter wheat returns to the previous place after four years, the ability of the environment to regulate the spread of diseases and pest populations is significantly improved [7].

The basis of the model of organic farming is the restoration of natural soil fertility; use of minimum cultivation; extensive use of perennial legumes, greens and organic fertilizers; preservation and accumulation of fertilizers in the soil and development of crop rotation. Crop rotation is often considered as the basis of the system of organic farming, which is emphasized by a number of researchers [4; 7; 16].

Analysis of current crop rotations, in which spelt wheat is present, and which are implemented in practice in the organic systems of the world [10], allowed to group crop rotations by component into three main groups (Table 2).

Table. 2. Duration of spelt rotation in actual organic crop rotations of organic wheat-producing countries
Source: own research

Crop rotation groups *	Predecessors of wheat			Wheat	Crops in crop rotation with wheat					Concentration of wheat in crop rotation	Duration of rotation (years)	Minimum break of years (Tr /)	Literature	Country
B1		GC	GC	WW	WR	SW	F1	Spe	SB	0,38	8	1	[12]	AT/DE
		GC	GC	WW	SO	SW	GL	Spe	WR	0,38	8	1	[12]	AT/DE
B2	GC	GC	Pot	WW	SO	F1	Spe	SB		0,25	8	2	[12]	AT/DE
	GC	GC	Pot	Spe	GL1	WR	SW			0,29	7	2	[12]	DE
		GC	WW	Spe	SN	F1	Spe	ZM		0,35	7	2	[1]	UA
C1			RC	WW	WR	SO	Spe	WR	SB	0,29	7	2	[17]	DE
			LuC	WW	SB	Spe	WR			0,40	5	1	[17]	DE

*** Crop rotation groups by component**

B1 - grain-grass, moderately rich in legumes crop rotation;

B2 - grain-grass, moderately saturated with row and forage crops crop rotation;

C1 - short rotary grain-grass crop rotations.

Countries of the European Union

AT - Austria; DE - Germany; UA – Ukraine (PE “Agroecology”).

Abbreviations of names of crops and their groups [9]

GC - Grass / clover (ryegrass / creeping clover);

Pot - Potatoes (Solanum tuberosum);

F1 - Different forage crops;

SB - Spring barley (Hordeum vulgare);

SO - Oats (Avena sativa);

SW - Spring wheat (Triticum aestivum);

WW - Winter wheat (Triticum aestivum);

WR - Winter rye (Secale cereale);

Spe - Spelt wheat (Triticum spelta);

SN - Sunflower (Heliánthus ánnuus);

GL1 - Vicia faba or Pisum sativum;

LuC - Alfalfa (Medicago sativa) and red clover (Trifolium pratense);

ZM - Silage corn (Zea mays).

In the case of grain use for baking bread and confectionery spelt placed after clover, alfalfa, legumes and other crops that are able to fix atmospheric nitrogen or have on the root system of symbiotic bacteria (crop rotation type B1).

After growing such crops, especially in wet years, due to the processes of mineralization,

nitrogen becomes available to spelt plants.

In organic production, Triticum spelta crops can be used as pastures, to combat erosion and as green manure, because spelt is a garment from crops that effectively use a high agrophone.

Quite often in organic crop production as precursors of legumes can be highly profitable legumes: beans, lentils, lupines, soybeans. However, long-rotation crop rotations are mandatory for such crops, as, for example, for peas in organic crops, according to recent studies [8], the return to the previous place can be more than six years. Reducing this period causes the accumulation of soil fungal diseases. And although the replacement of perennial legumes with annual legumes partially solves the problem of nitrogen nutrition, the balance of organic matter in the soil is deteriorating, which is unacceptable in organic production.

In the crop rotations shown in Table 2, the largest share of wheat in practice is 40% in short-rotation grain-grass crop rotations, which is much higher than recommended from a scientific point of view. In grain-grass crops, moderately rich in legumes, wheat saturation is sometimes as high as 25%. Saturation is largely due to the minimal break in the years between sowing wheat (including durum and spelt wheat) in crop rotation. As practice shows, quite often such a gap in the presented organic crop rotations can be 1-2 years, ie wheat in the crop rotation is grown every 2-3 years. Violation of scientifically sound recommendations in practice is explained by the presence in crop rotations of a significant variety of crop species that do not always effectively use soil fertility, which reduces the economic efficiency of organic crop rotations.

The maximum saturation of organic crop rotations with cereals, including wheat Triticum spelta is determined by the specialization of the producer, but should not exceed 50%. When choosing precursors for spelt wheat, it is necessary to take into account the moderate requirements of the crop to nitrogen nutrition and subsequent destination of grain from the crop. The interval of re-return of Triticum spelta to the previous place is limited by legumes, which in organic systems have the longest period of return to the previous place in crop rotation.

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WYSTĘPOWANIE CHORÓB RACIC W STADACH KRÓW MLECZNYCH W POWIECIE ŁOMŻYŃSKIM

OCCURRENCE OF HOOF DISEASES IN HERDS OF DAIRY COWS IN THE LOMZA POVIAT

Streszczenie

Celem badań było poznanie częstotliwości występowania chorób racic w stadach krów mlecznych w powiecie łomżyńskim, analiza ich przyczyn oraz sposobów leczenia i zapobiegania. Choroby racic są bardzo częstymi schorzeniami, jakie dotykają stada krów mlecznych hodowców z terenu powiatu łomżyńskiego. W stadach wszystkich badanych rolników dochodzi do kulawizny utrzymywanych zwierząt, a co za tym idzie, do brakowania stada. Najczęstszą przyczyną kulawizny są czynniki higieniczne, a zwłaszcza wilgotne stanowiska dla zwierząt, zabłocone wybiegi (78%), system żywienia i nieprawidłowo zbilansowane dawki pokarmowe (67%). Badania wykazały, że zapobieganie chorobom racic krów mlecznych wymaga wielu działań o charakterze profilaktycznym. Badani rolnicy jako główne wskazali korekcję racic (87%), kąpiele racic (83%) i stosowanie kwarantanny (56%).

Słowa kluczowe: krowa mleczna, stado, choroby racic, zanokcica, ochwat, kulawizna, powiat łomżyński, korekcja racic

Summary

The aim of the research was to learn about the frequency of hoof diseases in dairy herds in the Łomża poviat, to analyze their causes and methods of treatment and prevention Hoof diseases are very common diseases that affect herds of dairy cows breeders from the Łomża poviat. In the herds of all the farmers studied, there is a lameness of kept animals, and consequently, a shortage of the herd. The most common causes of lameness are hygienic factors, especially damp animal stands, muddy paddocks (78%), feeding system and improperly balanced food rations (67%). Studies have shown that the prevention of diseases of the hoofs of dairy cows requires many preventive measures. The surveyed farmers indicated the correction of hooves (87%), hoof baths (83%) and the use of quarantine (56%) as the main ones.
Key words: dairy cow, herd, hoof diseases, paronychia, laminitis, lameness, Łomża poviat, hoof correction (trimming)

Wstęp

Zdrowotność racic ma ogromne znaczenie z punktu widzenia ogólnej kondycji i zdrowia krów mlecznych. Warunkuje zarówno długość okresu użytkowania krów, jak też ilość produkowanego przez nie mleka [Stefański i in. 2014]. W ostatnich latach niepokojąco rośnie ilość schorzeń racic, co prowadzi do przedwczesnego brakowania stada. Najważniejszym objawem schorzeń nóg i racic zwierząt jest nieprawidłowe poruszanie nazywane kulawizną oraz ból. Kulawizna jest jednym z głównych czynników wywołujących straty w produkcji mleka, gdyż powoduje zmniejszenie pobierania paszy przez krowy, obniżenie dobrostanu zwierząt i ogólnej produkcyjności [Żółkiewski i in. 2018; Teter i in. 2017], zwiększenie zagrożenia ketozą, skutkuje spadkiem odporności na patogeny [Iwaszkiewicz 2020], prowadzi do strat ekonomicznych gospodarstw mlecznych z uwagi na wysokie koszty leczenia, obowiązkową karencję na mleko, gorsze wykorzystanie pasz, spadek kondycji, obniżoną wydajność, a także problemy z rozrodem. Uważa się ją za jedne z najbardziej kosztownych schorzeń w hodowli krów mlecznych, ograniczające jej rentowność [Stefański, 2013; Wilczek-Jagiełło 2017; Wójcik, Karpowicz 2018].

Schorzenia racic dzieli się na niezaraźliwe i zaraźliwe. Choroby zakaźne dotyczą skóry w przestrzeni międzypalcowej oraz okolicy od strony opuszki piętki - zapalenie skóry palców (choroba Mortellaro), zapalenie skóry szpary międzyracicowej, zanokcica (ropowica międzypalcowa) oraz erozja rogu opuszek [Bach i in., 2019]. Natomiast w grupie chorób niezakaźnych znajduje się wrzód podeszwy (Zespół Rustelholza), choroba linii białej, gnicie rogu,

ochwat. Zaniedbane i nieleczone choroby racic mogą skutkować powstawaniem poważnych powikłań [Karpowicz 2012].

Występowanie chorób racic istotnie wpływa na dyskomfort i ból zwierząt (niezachowanie dobrostanu), poruszanie się, chęć pobierania suchej masy i paszy, jest niebezpieczne dla wymienia krów, jak również wpływa niekorzystnie na rozród (wydłuża okres międzyciążowy, zmniejsza skuteczność inseminacji) jest powodem brakowania i upadków, więc zmniejsza zyski ekonomiczne hodowców [Januś 2018; Michniewicz 2021; Teter i in. 2017]. Odsetek krów eliminowanych ze stad z powodu schorzeń racic oraz ich powikłań wynosi 15-25%, natomiast w stadach wysokowydajnych dochodzi nawet do 50% [Karpowicz 2012; Pokorska i in. 2012].

Kulawizna u bydła mlecznego posiada wieloczynnikowe podłoże, począwszy od czynników genetycznych, technologicznych dotyczących bezpośrednio utrzymania zwierząt, wyposażenia technologicznego, składu dawki paszowej, pielęgnacji i higieny zwierząt. Przyczyn tego stanu należy upatrywać w urazach mechanicznych, błędach żywieniowych, złych rozwiązaniach technologicznych w obrębie gospodarstwa, braku higieny w oborze [Michniewicz 2021].

Wczesne wykrycie kulawizny zwiększa prawdopodobieństwo skutecznego wyleczenia, zmniejszenia cierpienia zwierząt i zapobiega dużym stratom finansowym hodowców [Marchewka, Gołębiewski 2018]. Leczenie polega na zakładaniu opatrunków oraz antybiotykoterapii.

Jedynie kompleksowe podejście do problemu, pielęgnacja krów, dbałość o zoptymalizowaną dawkę pokarmową pozwoli na zmniejszenie skali zjawiska i zapewni bydłu zdrowe racice, od których w dużej mierze zależy opłacalność produkcji gospodarstw mleczarskich [Michniewicz 2021]. Skuteczne eliminowanie kulawizn wymaga wdrożenia określonych procedur postepowania w gospodarstwie w obszarze monitoringu, oceny przyczyn, skali zagrożenia w ramach stada oraz leczenia przypadków chorób racic u krów mlecznych. Ważna jest profilaktyka w zakresie pielęgnacji racic, a także poprawa warunków bytowych zwierząt i właściwe żywienie [Teter i in. 2017].

Ważne ogniwo profilaktyki chorób racic bydła mlecznego stanowi fachowe wykonywanie bieżącej i okresowej korekcji racic, co zapewnia zwierzętom swobodne poruszanie się i wzmacnia układ narządów ruchu. Duże znaczenie w profilaktyce i terapii przypisuje się również kąpielom dezynfekującym racic, wykonywanym z zastosowaniem odpowiednich płytkich basenów, mat, specjalnych materaców bądź preparatów pianowych. Stopniowe eliminowanie poszczególnych punktów krytycznych, wpływających na powstawanie chorób kończyn, w dużym stopniu pozwala zminimalizować ten problem w stadzie.

Cel, przedmiot i metodyka badań

Celem badań było poznanie częstotliwości występowania chorób racic w stadach krów mlecznych w powiecie łomżyńskim, analiza ich przyczyn oraz sposobów leczenia i zapobiegania.

Na potrzeby badań postawiono następujący problem główny:

Jakie choroby racic i z jaką częstotliwością występują w stadach krów mlecznych ?

Wyróżniono ponadto kilka problemów szczegółowych:

1. Jakie choroby racic w stadach krów mlecznych generują największe straty dla hodowców?
2. Jakie są najczęstsze przyczyny kulawizny bydła mlecznego?
3. Jakie są skutki kulawizny u krów mlecznych?
4. Jakie zabiegi lecznicze są podejmowane u krów z chorobami racic?
5. W jaki sposób rolnicy zapobiegają chorobom racic w stadach krów mlecznych?

Badania własne przeprowadzono metodą sondażu diagnostycznego we wrześniu 2021r. wśród losowo wybranych 100 hodowców bydła mlecznego z terenu powiatu łomżyńskiego. Stosownie do wybranej metody badawczej za najbardziej odpowiednią uznano technikę ankiety pisemnej. Ankiety dostarczyli rolnikom pracownicy firmy Pro Care Daniel Tyborowski, zajmującej się korekcją racic. Rolnicy wypełnili przygotowaną ankietę, zawierającą pytania dotyczące chorób racic krów mlecznych. Kwestionariusz ankiety składał się z trzech części: wprowadzającej, głównej i metryczki. Pytania ankietowe zaopatrzono w kafeterię zamkniętą i półotwartą. W części zasadniczej znalazło się 13 pytań, natomiast w metryczce 7 pytań dotyczących danych na temat osób biorących udział w badaniu.

Zbadano i przeanalizowano opinię rolników odnośnie częstotliwości występowania chorób racic bydła mlecznego na terenie powiatu łomżyńskiego, przyczyn schorzeń i nieprawidłowości kończyn, objawów, leczenia i działań profilaktycznych minimalizujących problemy krów w tym obszarze.

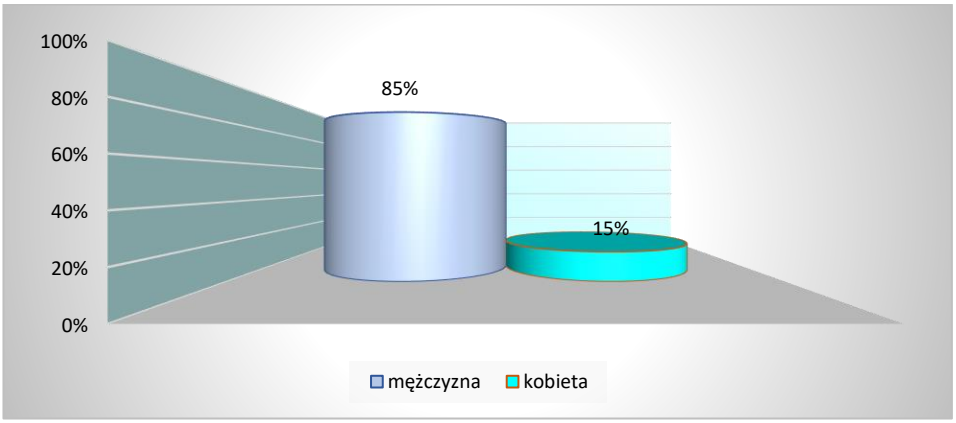
Badania przeprowadzono w gospodarstwach specjalizujących się w hodowli bydła mlecznego, zlokalizowanych na terenie powiatu łomżyńskiego. Powiat łomżyński leży w zachodniej części województwa podlaskiego i graniczy z powiatem: białostockim, grajewskim, kolneńskim, zambrowskim, monieckim, ostrołęckim, i ostrowskim. Jego powierzchnia wynosi 1355 km^2 i obejmuje administracyjnie dziewięć jednostek samorządowych: dwie gminy wiejsko-miejskie Jedwabne i Nowogród, gminę miejską Łomża, gminy wiejskie: Łomża, Miastkowo, Piątnica, Przytuły, Śniadowo, Wizna, i Zbójna.

Według danych z 30 czerwca 2020 roku powiat zamieszkiwały 50 894 osoby [Statystyczne vademecum samorządowca 2020, powiat łomżyński).

Wyniki badań

W badaniu uczestniczyło 100 rolników z terenu powiatu łomżyńskiego. Struktura respondentów przedstawia się następująco:

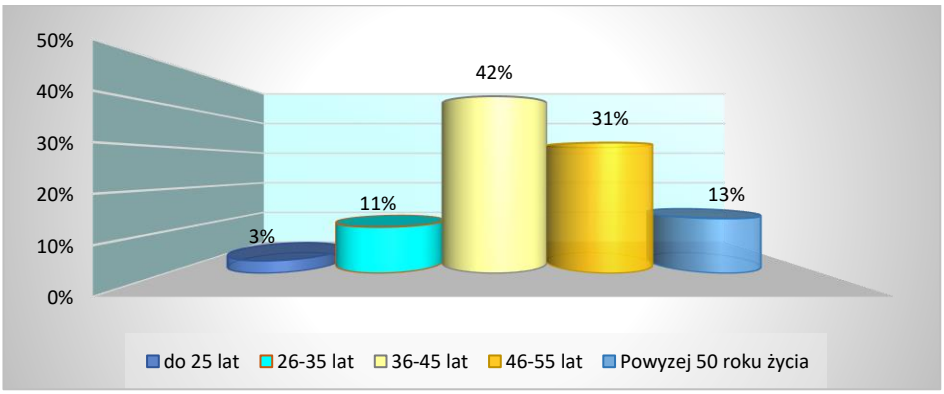
Wśród badanych było 15% kobiet i 85% mężczyzn (ryc. 1).



Ryc. 1. Struktura respondentów ze względu na płeć
Źródło: Badania własne

Figure 1. Structure of respondents by gender
Source: Own study.

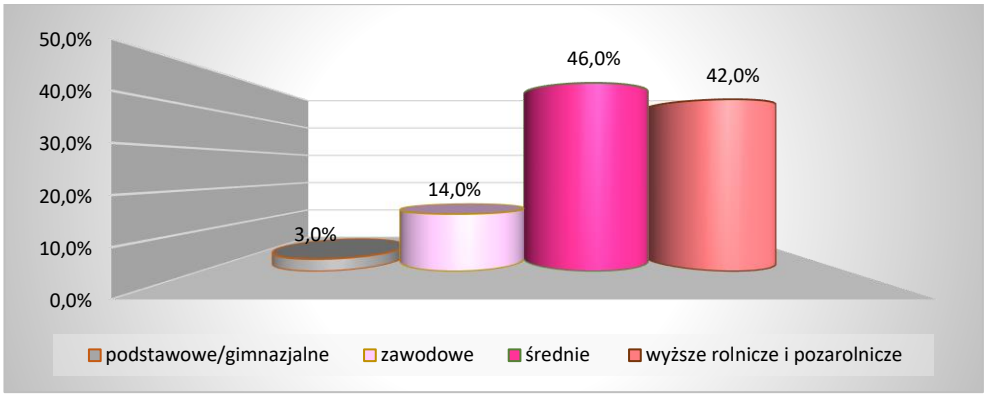
Najliczniejszą grupa badanych rolników były osoby w wieku 36-45 lat (42%), 31% to respondenci w przedziale wiekowym 46-55 lat, 13% ankietowanych było w wieku powyżej 55 roku życia, 11% stanowili hodowcy bydła w wieku 26-35 lat, natomiast najmniej respondentów to ludzie młodzi, do 25 lat (ryc. 2).



Ryc. 2. Struktura respondentów ze względu na wiek
Źródło: Badania własne

Figure 2. Structure of respondents by age
Source: Own study.

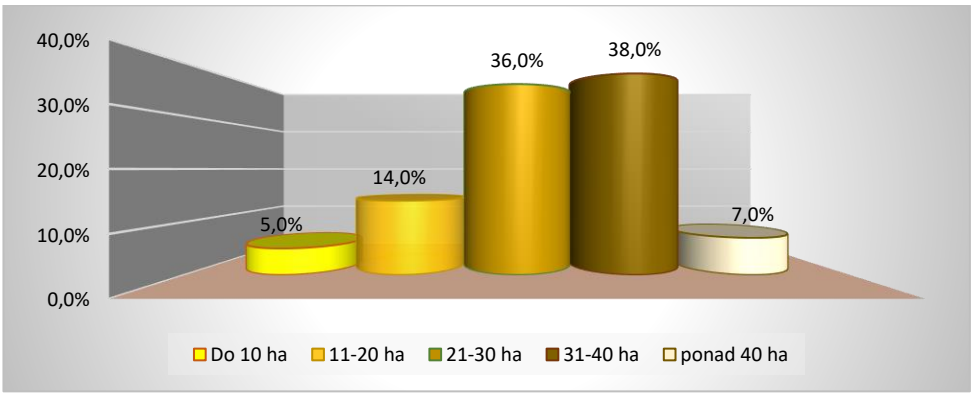
Większość respondentów legitymowała się wykształceniem średnim (46%), 42% zdobyło wykształcenie wyższe rolnicze bądź pozarolnicze, 14% zakończyło edukację na poziomie szkoły zawodowej, zaś 3% zdobyło wykształcenie podstawowe bądź gimnazjalne (ryc. 3).



Ryc. 3. Struktura respondentów ze względu na wykształcenie
Źródło: Badania własne

Figure 3. Structure of respondents due to education
Source: Own study.

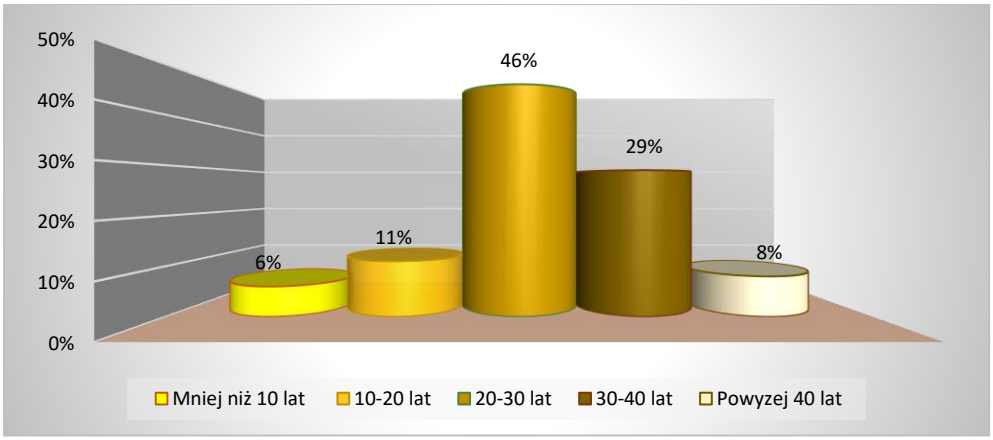
Rycina 4 przedstawia powierzchnię gospodarstw badanych rolników. Z danych wynika, że 38% ankietowanych gospodaruje na 31-40 ha ziemi, 36% prowadzi gospodarstwo o areale 21-30 ha, 14% -11-20 ha, zaledwie 7% hodowców bydła gospodaruje na ponad 40 ha ziemi, zaś 5% posiada do 10 ha ziemi.



Ryc. 4. Powierzchnia gospodarstwa
Źródło: Badania własne

Figure 4. Area of the holding
Source: Own study.

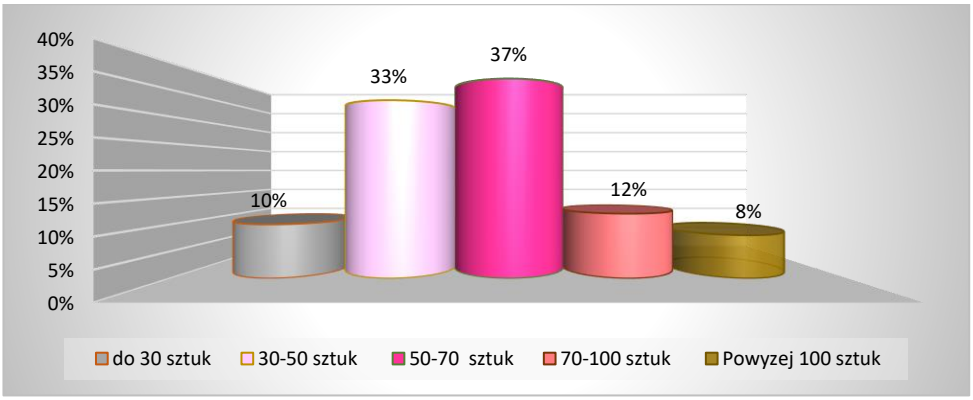
Z ryciny 5 przedstawiającej staż prowadzenia gospodarstwa przez rolników wynika, że najwięcej rolników prowadzi gospodarstwo 20-30 lat (46%), 29% ankietowanych gospodaruje już 30-40 lat, 11% 10-20 lat, 8% powyżej 40 lat, natomiast 6% prowadzi własne gospodarstwo krócej niż 10 lat.



Ryc. 5. Staż prowadzenia gospodarstwa
Źródło: Badania własne

Figure 5. Farming experience
Source: Own study.

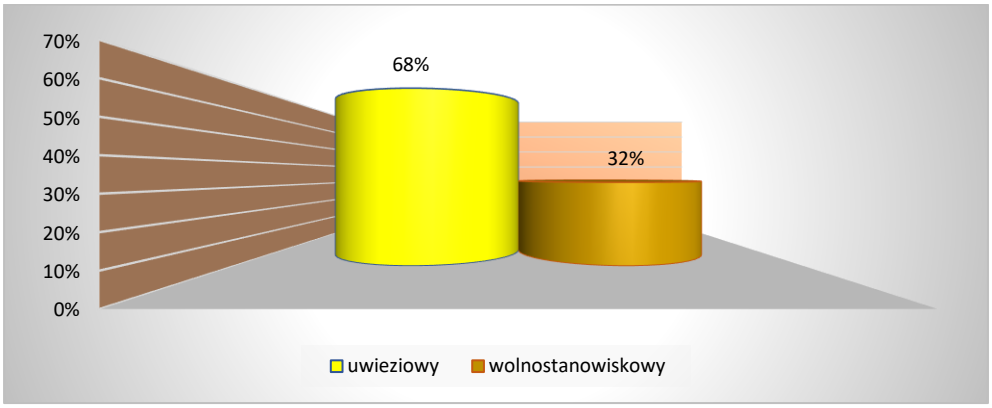
Więcej niż jedna trzecia hodowców (37%) posiada w swoim stadzie 50-70 sztuk bydła, 33% deklaruje posiadanie 30-50 sztuk krów, 12% ma od 70 do 100 sztuk bydła, natomiast 10 % posiada do 30 sztuk krów, 8% respondentów hoduje powyżej 100 sztuk krów mlecznych (ryc. 6).



Ryc. 6. Liczba krów mlecznych w stadzie
Źródło: Badania własne

Figure 6. Number of dairy cows in the herd
Source: Own study.

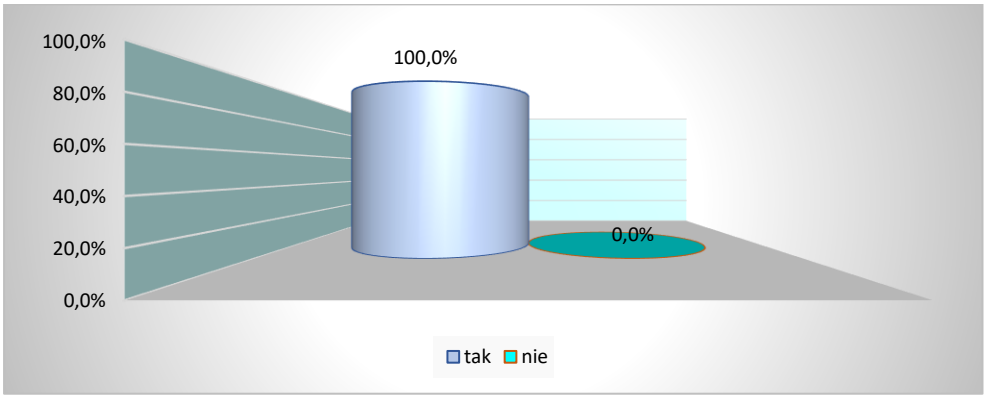
Większość rolników utrzymuje bydło w systemie uwięziowym (68%), natomiast 32% w wolnostanowiskowym (ryc. 7).



Ryc. 7. System utrzymania bydła mlecznego
Źródło: Badania własne

Figure 7. Dairy cattle maintenance system
Source: Own study.

Zapytano rolników, czy w stadzie bydła mlecznego, które utrzymują w swoim gospodarstwie występują u krów choroby racic. Otrzymane odpowiedzi prezentuje ryc. 8. Wszyscy badani rolnicy zgodnie stwierdzili, iż w stadach bydła, które utrzymują w swoim gospodarstwie występują u krów choroby racic.

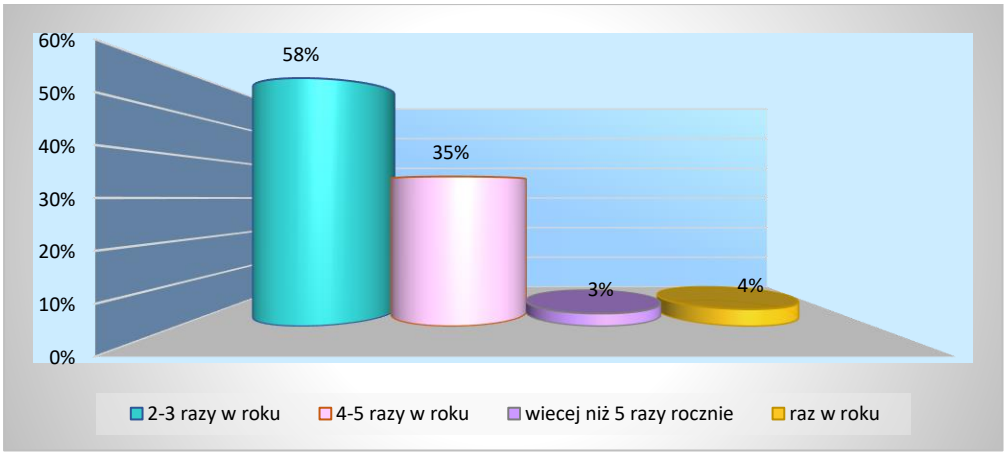


Ryc. 8. Występowanie chorób racic w stadzie bydła mlecznego
Źródło: Badania własne

Figure 8. The occurrence of hoof diseases in a dairy herd
Source: Own study.

Postanowiono sprawdzić, z jaką częstotliwością w stadach bydła ankietowanych hodowców występuje kulawizna. Rozkład odpowiedzi przedstawiono na ryc. 9.

Z wypowiedzi 58% ankietowanych wynika, że do zachorowań na kulawiznę dochodzi 2-3 razy w roku. Chorobę tę 4-5 razy w roku przechodzą stada 35% respondentów, zaś 3% deklaruje występowanie chorób racic więcej niż 5 razy w roku, 4% raz w roku.

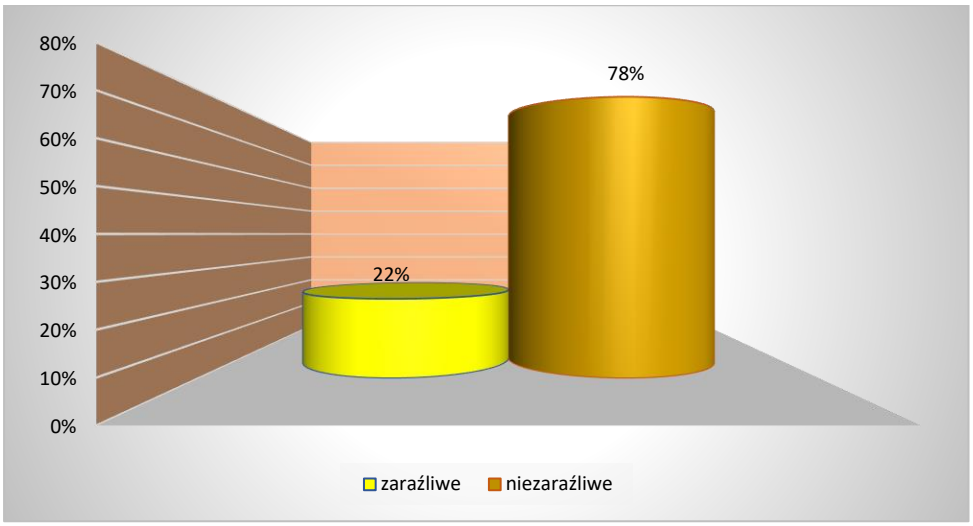


Ryc. 9. Częstotliwość zachorowań bydła na choroby racic na przestrzeni roku
Źródło: Badania własne.

Figure 9. Frequency of cattle diseases per year
Source: Own study.

Następnie skierowano do badanej grupy pytanie: Jakie choroby krów mlecznych występują najczęściej w Pana/i stadzie? Wyniki prezentuje ryc. 10.

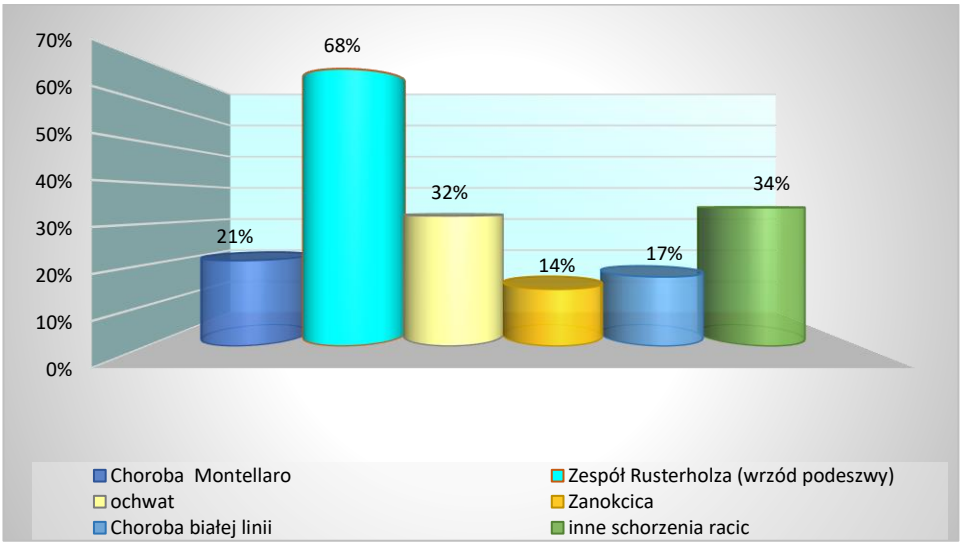
Z badań wynika, że zdaniem 78% najczęściej w stadzie bydła pojawiają się choroby niezaraźliwe, natomiast według 22% dominują choroby zakaźne.



Ryc. 10. Choroby racic krów z podziałem na zaraźliwie i niezaraźliwe
Źródło: Badania własne.

Figure 10. Diseases of cow hooves divided into contagious and non-contagious
Source: Own study.

Spytano respondentów, które z chorób racic występują najczęściej w ich stadach. Dane na ten temat prezentuje ryc. 11.



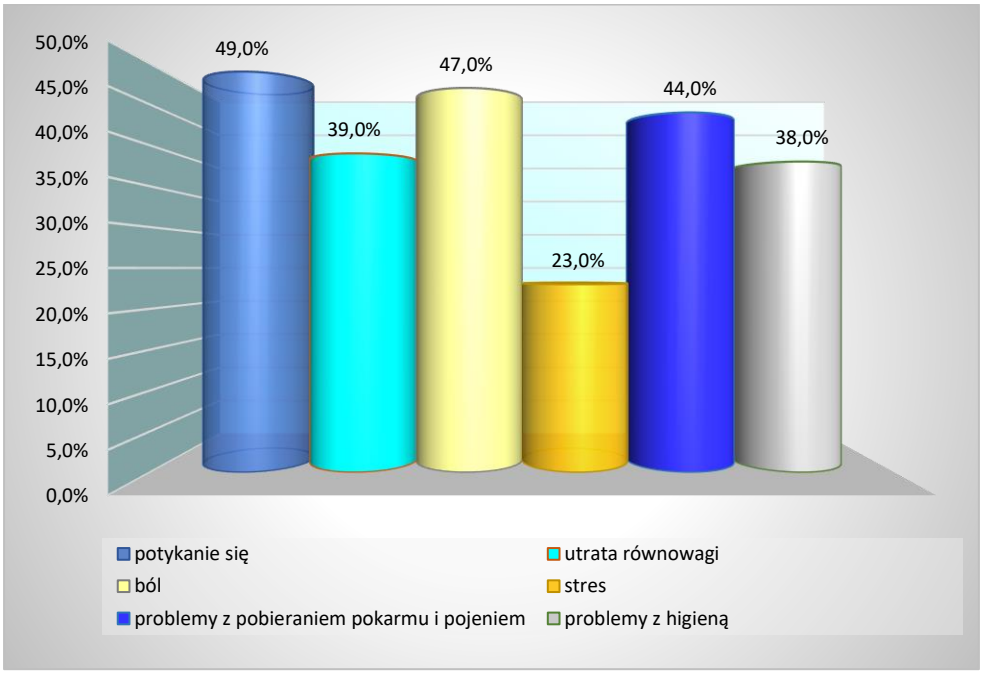
Ryc. 11. Najczęstsze choroby racic bydła w stadach respondentów
Źródło: Badania własne.
**** respondenci mogli wskazać więcej niż jedną odpowiedź***

Figure 11. The most common diseases of cattle hooves in respondents' herds
Source: Own study.
**** respondents could indicate more than one answer***

Analizując dane zgromadzone na ryc. 11 należy wysunąć wniosek, iż najczęstszą chorobą racic bydła mlecznego jest Zespół Rusterholza (wrzód podeszwy). Taką odpowiedź podało 68% respondentów. Na drugim miejscu znalazła się odpowiedź o innych schorzeniach racic (34%), natomiast co trzeci ankietowany (32%) podał ochwat. Częstą choroba racic jest także choroba Montellaro (21%), choroba białej linii (17%), najrzadziej występuje zanokcica (14%).

W dalszym toku badań postanowiono ustalić, jakie objawy manifestują chore zwierzęta. Szczegółowy rozkład otrzymanych odpowiedzi umieszczono na ryc. 12.

W opinii rolników chore zwierzęta manifestują wiele różnych objawów. Najczęściej chore krowy potykają się (49%), czują ból (47%), mają problemy z pobieraniem pokarmu i pojeniem (44%). Część krów traci równowagę (39%), inne wykazują problemy z higieną (38%), 23% badanych wskazało na stres zwierząt w związku z chorobą racic.



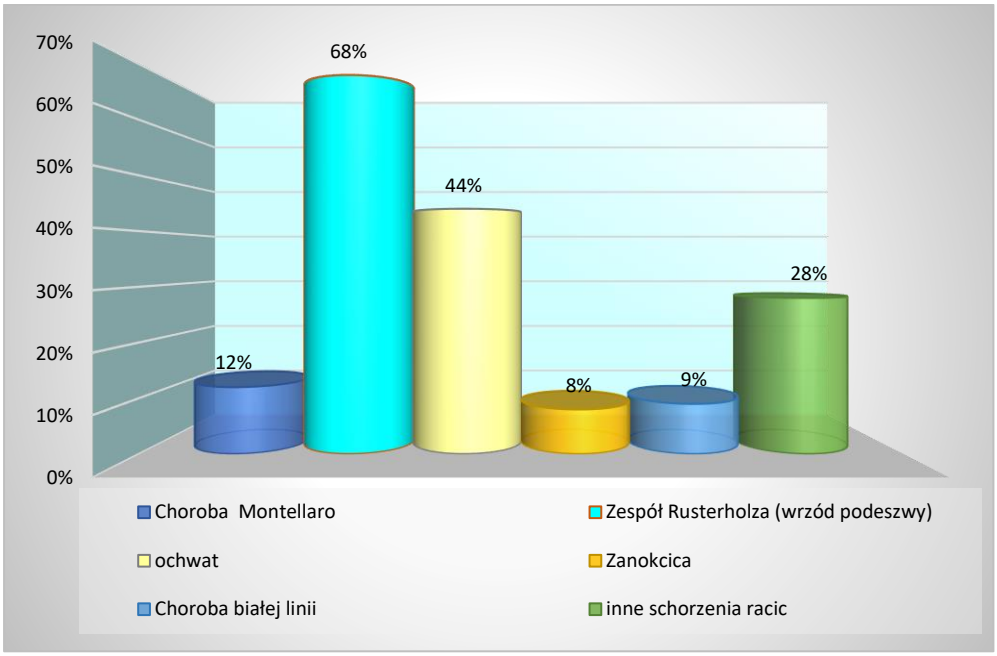
Ryc. 12. Objawy manifestowane przez chore zwierzęta
Źródło: Badania własne.
**** respondenci mogli wskazać więcej niż jedną odpowiedź***

Figure 12. Symptoms manifested by sick animals
Source: Own study.
**** respondents could indicate more than one answer***

Choroby racic generują wysokie straty ekonomiczne dla hodowców. Poproszono

ankietowanych rolników, by wskazali, które ze schorzeń racic krów prowadzą do największych szkód w stadzie bydła. Wyniki zawiera ryc. 13.

Z badań wynika, że najwięcej strat ekonomicznych generuje wrzód podeszwy. Takie zdanie wyraziło 68% badanych. Natomiast 44 % hodowców wskazało na ochwat, 28% podało inne schorzenia racic, nie wymienione w ankiecie, 12% zwróciło uwagę na chorobę Montellaro. Mniejsze szkody z w stadach bydła i szkody wynikają z zachorowania krów na chorobę białej linii (9%) i zanokcicę (8%).



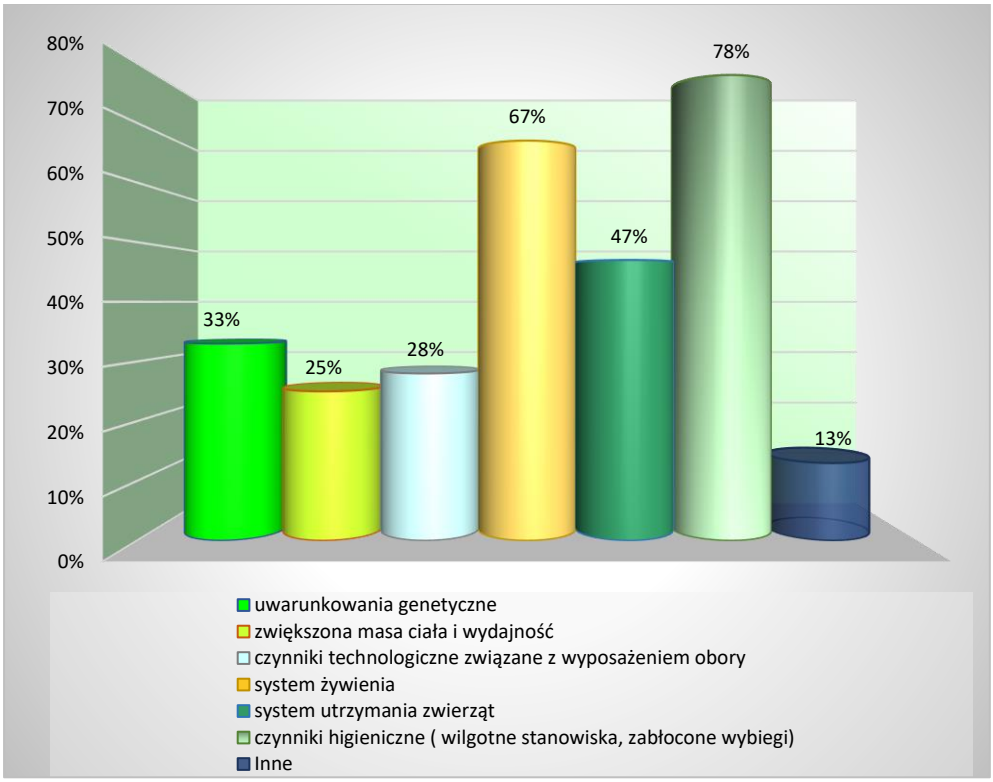
Ryc. 13. Choroby racic krów generujące największe straty hodowców bydła
Źródło: Badania własne.
**** respondenci mogli wskazać więcej niż jedną odpowiedź***

Figure 13. Cow hoof diseases generating the greatest losses for cattle breeders
Source: Own study.
**** respondents could indicate more than one answer***

Kolejne pytanie ankietowe było następujące: Co jest Pana/i zdaniem najczęstszą przyczyną kulawizny bydła mlecznego? Otrzymane odpowiedzi prezentuje ryc. 14.

Z wypowiedzi rolników wynika, że najczęstszą przyczyną kulawizny bydła mlecznego są czynniki higieniczne, a zwłaszcza wilgotne stanowiska dla zwierząt, zabłocone wybiegi. Taką odpowiedź podało 78% respondentów. Kolejna istota przyczyna chorób kończyn krów to system żywienia i nieprawidłowo zbilansowane dawki pokarmowe (67%). Zdaniem 47% rolników duże

znaczenie ma system utrzymania zwierząt, a także uwarunkowania genetyczne (33%) i czynniki technologiczne związane z wyposażeniem obory (28%). Mniejsze znaczenie w etiologii chorób racic badani przypisali zwiększonej masie ciała zwierząt i wydajności mlecznej, predysponującej do tego typu chorób. Inne czynniki podało 13% respondentów.



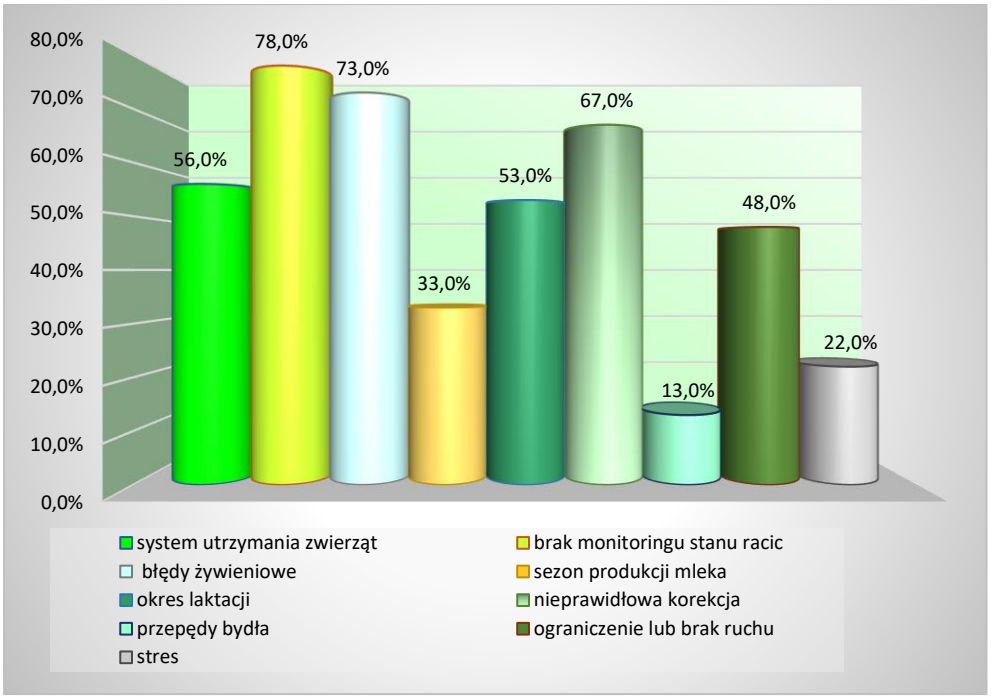
Ryc. 14. Najczęstsze przyczyny kulawizny bydła mlecznego
Źródło: Badania własne.
**** respondenci mogli wskazać więcej niż jedną odpowiedź***

Figure 14. The most common causes of lameness of dairy cattle
Source: Own study.
**** respondents could indicate more than one answer***

Poproszono hodowców bydła, by wypowiedzieli się w kwestii czynników zwiększających ryzyko wystąpienia u krów chorób racic. Szczegółowe dane na ten temat przedstawiono na ryc. 15.

Badani do czynników zwiększających ryzyko wystąpienia u krów chorób racic zaliczyli: brak monitoringu stanu racic (78%), błędy żywieniowe (73%), nieprawidłową korekcję racic (67%), system utrzymania zwierząt (56%), okres laktacji (53%), ograniczenia bądź brak ruchu

(48%). Za mniej ważne czynniki uznano: sezon produkcji mleka (33%), stres (22%) i przepędy bydła (13%).



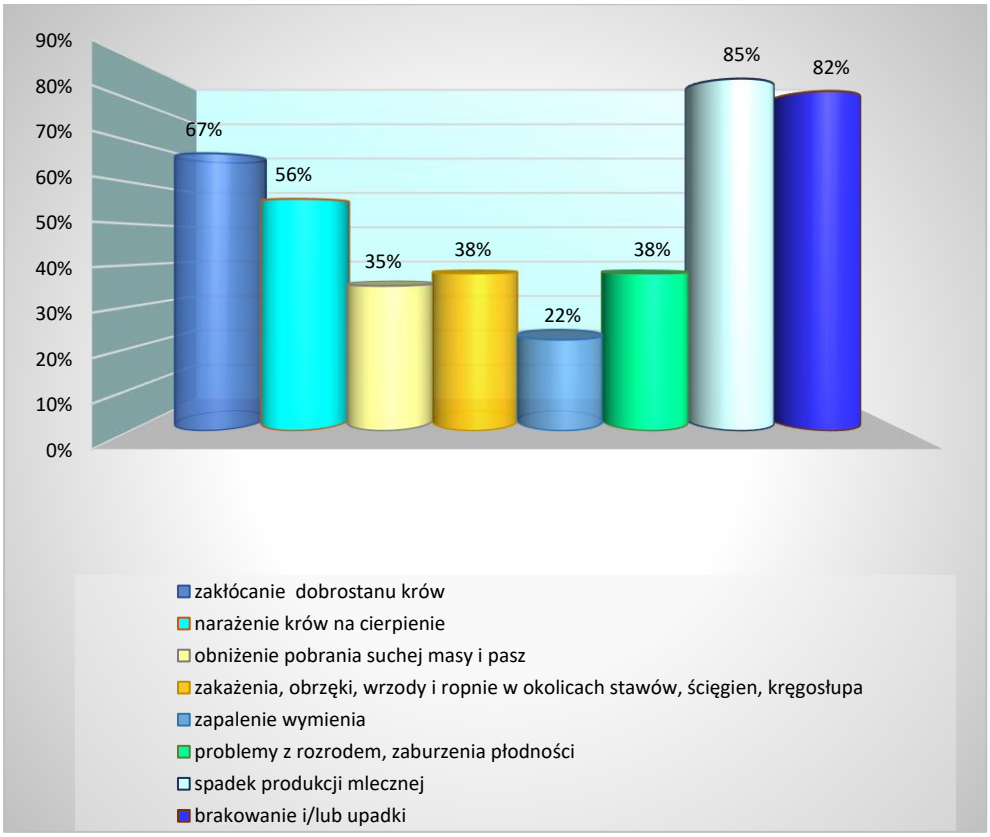
Ryc. 15. Czynniki zwiększające ryzyko wystąpienia chorób racic u krów
Źródło: Badania własne.
**** respondenci mogli wskazać więcej niż jedną odpowiedź***

Figure 15. Factors that increase the risk of hoof diseases in cows
Source: Own study.
**** respondents could indicate more than one answer***

Następnie skierowano do rolników pytanie o skutki kulawizny u bydła mlecznego. Odpowiedzi prezentuje ryc. 16

Analizując dane zamieszczone na ryc. 33 należy wnioskować, iż kulawizna zwierząt niesie wiele negatywnych skutków dla krów, całego stada oraz dla hodowców. Według 85% respondentów dochodzi do spadku produkcji mlecznej, 82% stwierdziło, że kulawizna stanowi przyczynę brakowania i upadków w stadzie. Zdaniem 67% badanych zakłóca w dużej mierze dobrostan krów, zaś 56% podało narażenie zwierząt na ból i cierpienie. W opinii 38% ankietowanych choroby racic skutkują zakażeniami, obrzękami, wrzodami i ropniami w okolicach stawów, ścięgien, kręgosłupa, natomiast 35% uważa, że obniżają pobór suchej masy i pasz przez bydło, prowadząc do niewłaściwego odżywiania, 38% wskazało na problemy z rozrodem i

zaburzenia płodności, a 22% zwróciło uwagę na zapalenie wymienia.

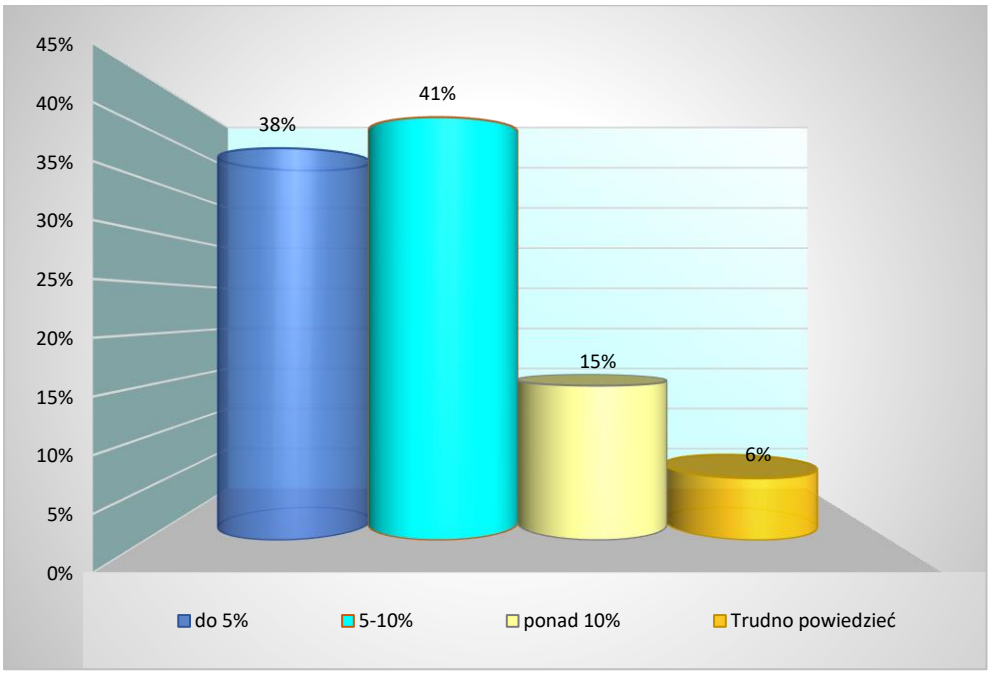


Ryc. 16. Skutki kulawizny u bydła mlecznego
Źródło: Badania własne.
**** respondenci mogli wskazać więcej niż jedną odpowiedź***

Figure 16. Effects of lameness in dairy cattle
Source: Own study.
**** respondents could indicate more than one answer***

Zapytano rolników jaki procent stada brakuje im rocznie z powodu chorób racic. Wyniki prezentuje ryc. 17.

Z wypowiedzi 41% hodowców bydła wynika, że każdego roku brakowanie w stadzie bydła mlecznego wynosi 5-10%, 38% wskazało braki na poziomie do 5%, natomiast według 15% badanych brakowanie w stadzie oscyluje powyżej 10%, 6% nie miało na ten temat wyrobionego zdania i wybrało opcję „trudno powiedzieć".

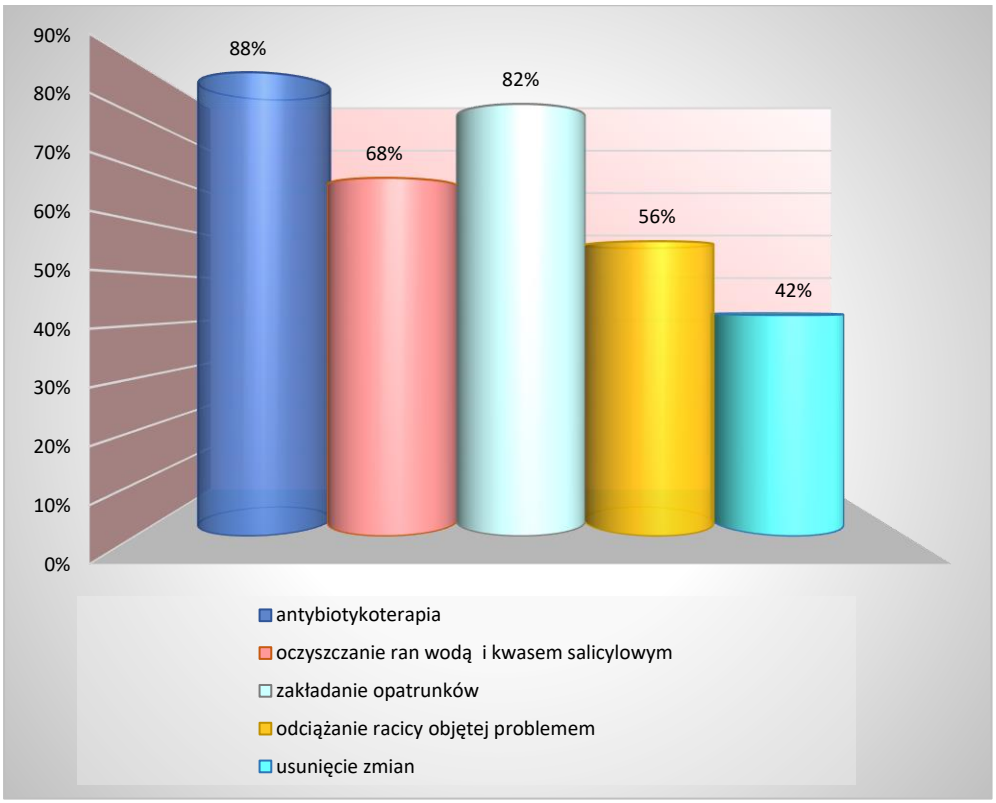


Ryc. 17. Coroczne brakowanie stada z powodu chorób racic
Źródło: Badania własne.

Figure 17. Annual shortage of the herd due to hoof diseases
Source: Own study.

Leczenie chorób racic u krów mlecznych bywa procesem długotrwałym i niejednokrotnie kosztownym. Postanowiono dowiedzieć się, w jaki sposób postępują hodowcy z chorymi sztukami bydła. Wyniki przedstawia ryc. 18.

Hodowcy bydła wobec krów z kulawizną podejmują wiele działań. Zabiegi lecznicze obejmują antybiotykoterapię (88%), zakładanie opatrunków (82%), oczyszczanie ran wodą i kwasem salicylowym (68%), odciążanie racicy objętej problemem (56%) i usunięcie zmian (42%).

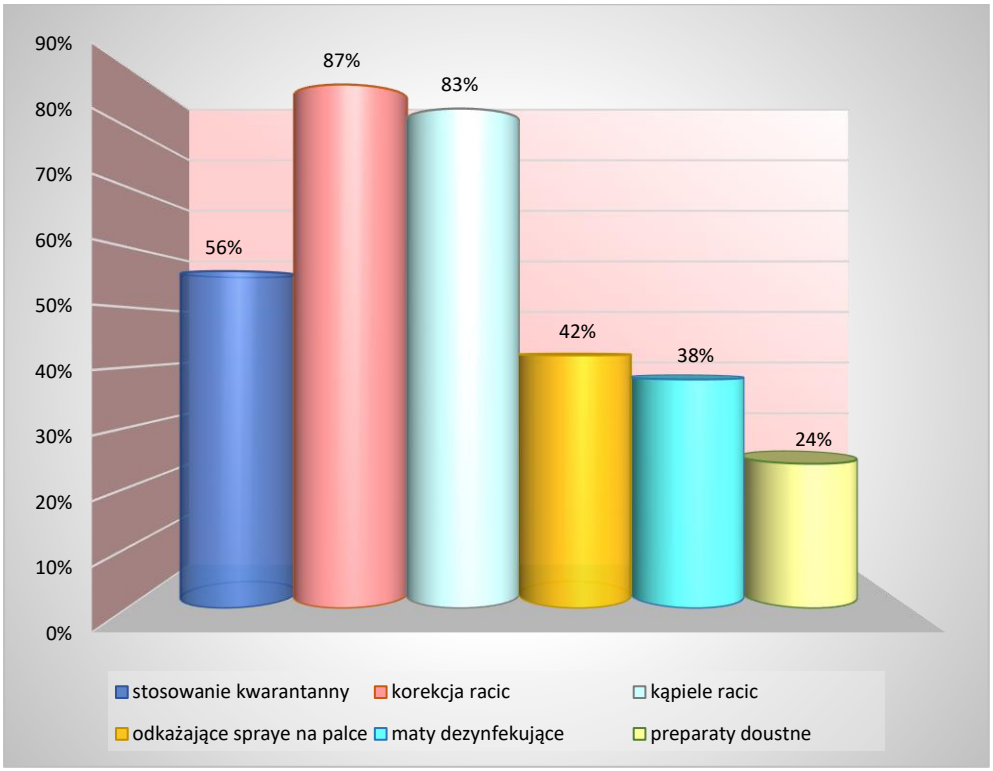


Ryc. 18. Zabiegi lecznicze podejmowane u krów z kulawizną
Źródło: Badania własne.
**** respondenci mogli wskazać więcej niż jedną odpowiedź***

Figure 18. Therapeutic procedures for cows with lameness
Source: Own study.
**** respondents could indicate more than one answer***

Niezwykle ważna w zapobieganiu i terapii chorób racic krów jest szeroko rozumiana profilaktyka. Spytano rolników, jakie czynności profilaktyczne stosują w celu zapobiegania chorobom racic u krów mlecznych. Otrzymane odpowiedzi umieszczono na ryc. 19.

Badania wykazały, że rolnicy podejmują wiele działań o charakterze profilaktycznym w celu zapobiegania chorobom racic u krów mlecznych. Przede wszystkim stosują korekcję racic (87%), kąpiele racic (83%) i stosują kwarantanny (56%), jeśli nowa krowa trafia do stada. Część hodowców (42%) wykorzystuje odkażające spraye na palce, maty dezynfekujące (38%) i aplikuje zwierzętom preparaty doustne (24%).



Ryc. 19. Czynności profilaktyczne stosowane w celu zapobiegania chorobom racic u krów mlecznych
Źródło: Badania własne.
**** respondenci mogli wskazać więcej niż jedną odpowiedź***

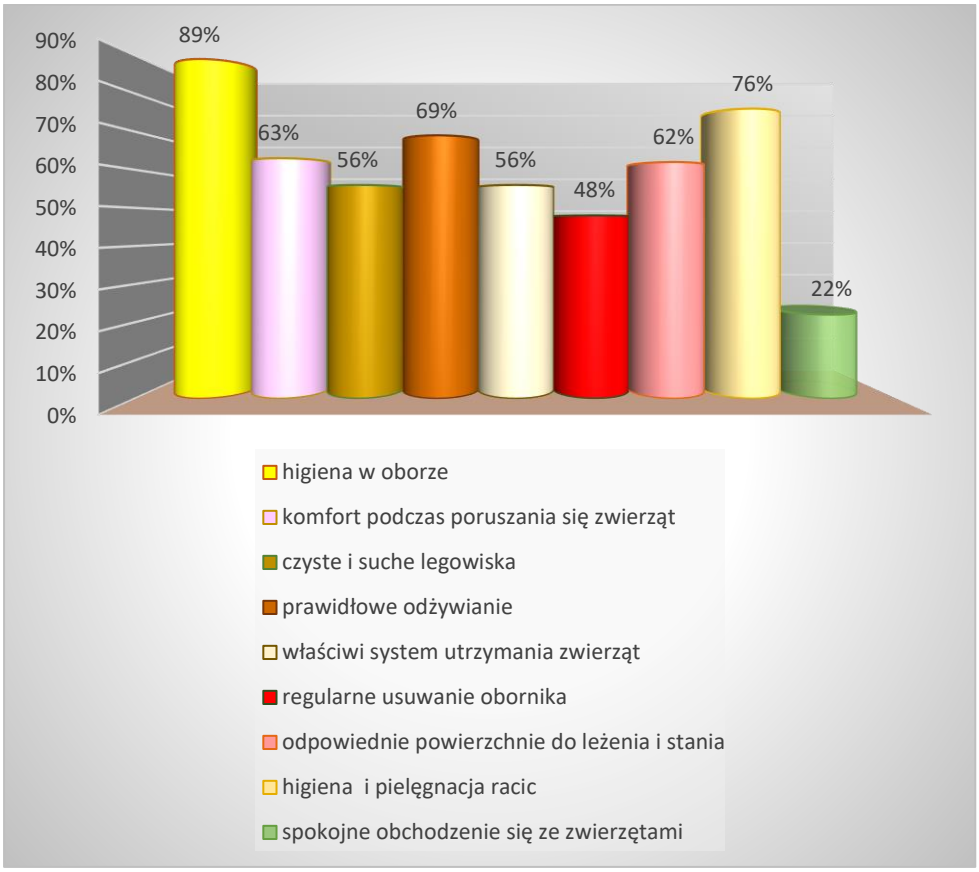
Figure 19. Prophylactic measures used to prevent hoof diseases in dairy cows
Source: Own study.
**** respondents could indicate more than one answer***

Respondenci zostali zapytani o czynniki mogące zminimalizować problem występowania chorób racic w stadzie bydła mlecznego. Ich wypowiedzi zawiera ryc. 20.

Badani rolnicy do czynników mogących zminimalizować problem występowania chorób racic w stadzie bydła mlecznego zaliczyli:

- higienę w oborze (89%),
- higienę i pielęgnację racic (76%),
- prawidłowe odżywianie (69%),
- komfort podczas poruszania się zwierząt (63%),
- odpowiednie powierzchnie do leżenia i stania (62%),
- czyste i suche legowiska (56%),
- właściwi system utrzymania zwierząt (56%),

- regularne usuwanie obornika (48%),
- spokojne obchodzenie się ze zwierzętami, niestresowanie krów (22%).



Ryc. 20. Czynniki mogące zminimalizować problem występowania chorób racic w stadzie bydła mlecznego
Źródło: Badania własne.
**** respondenci mogli wskazać więcej niż jedną odpowiedź***

Figure 20. Factors that can minimize the problem of hoof diseases in a dairy herd
Source: Own study.
**** respondents could indicate more than one answer***

Dyskusja wyników

Schorzenia racic u bydła mlecznego prowadzą do przedwczesnego brakowania stada. Najważniejszy ich objaw to nieprawidłowe poruszanie krów, czyli kulawizna i ból. Odsetek krów eliminowanych ze stad z powodu schorzeń racic oraz ich powikłań wynosi 15-25%, natomiast w stadach wysokowydajnych dochodzi nawet do 50% [Karpowicz 2012]. Chmielewski [2019] stoi

na stanowisku, że nawet 50% zwierząt w stadzie może wykazywać problemy z kończynami lub racicami, co staje się główną przyczyną ich brakowania ze stada.

Zgodnie z badaniami literaturowymi w skali światowej choroby palców występują średnio u 30-70% krów w stadzie, a zjawisko to cechuje tendencja wzrostowa [Skrzypek i in. 2016].

Z badań własnych wynika, że do zachorowań bydła mlecznego na kulawiznę najczęściej dochodzi 2-3 razy w roku, rzadziej 4-5 razy w roku. Najczęstszą chorobą racic bydła mlecznego jest Zespół Rusterholza (wrzód podeszwy), choroba Montellaro i ochwat, rzadziej występuje choroba białej linii i zanokcica.

Z badań Skrzypka i in. [2015] wynika, że choroby racic stwierdzono u 60,7% badanych krów w stadzie. Najczęściej występowała erozja rogu pięty (41,4%), rzadziej owrzodzenia podeszwy (23,6%), choroba białej linii (11,4%), ropowica międzypalcowa (3,6%), ochwat (3,6%) i przerost międzypalcowy (2,9%).

Badania własne wykazały, że najczęstszą przyczyną kulawizny bydła mlecznego są czynniki higieniczne, a zwłaszcza wilgotne stanowiska dla zwierząt, zabłocone wybiegi, system żywienia i nieprawidłowo zbilansowane dawki pokarmowe, system utrzymania zwierząt, a także uwarunkowania genetyczne i czynniki technologiczne związane z wyposażeniem obory. Ustalono, że do czynników zwiększających ryzyko wystąpienia u krów chorób racic należy brak monitoringu stanu racic, błędy żywieniowe, nieprawidłowa korekcja racic, system utrzymania zwierząt, okres laktacji, ograniczenia bądź brak ruchu.

Wyniki te są zbieżne z badania innych naukowców. Kulawizna u bydła mlecznego posiada wieloczynnikowe podłoże. Bierze się pod uwagę czynniki genetyczne, technologiczne wiązane z utrzymaniem zwierząt, wyposażeniem technologicznym, żywienie, pielęgnację i higienę zwierząt. Przyczyny kulawizny to urazy mechaniczne, błędy żywieniowe, złe rozwiązania technologiczne w gospodarstwie oraz brak higieny w oborze [Michniewicz 2021].

Skrzypek i in. [2015] uważają, że czynniki istotnie zwiększające ryzyko wystąpienia schorzeń racic to późniejsze dni w mleku (> 120), starszy wiek krowy i wielorodność oraz niższy udział oryginalnej puli genów holsztyńsko-fryzyjskich (< 97%). Nie wykazano związku z wydajnością mleka w równoczesnej 305-dniowej laktacji.

Kulawizna prowadzi do strat w produkcji mleka, obniża dobrostanu zwierząt i ogólną produkcyjność, o czym wspominają Żółkiewski i in. [2018] oraz Teter i in. [2017]. Iwaszkiewicz [2020] dodaje, że zwiększa zagrożenia ketozą, skutkuje spadkiem odporności bydła na patogeny chorobotwórcze, generuje straty ekonomiczne gospodarstw mlecznych ze względu na wysokie koszty leczenia, a także obowiązkową karencję na mleko, gorsze wykorzystanie pasz, spadek kondycji zwierząt, obniżoną wydajność i problemy z rozrodem. Zdaniem Stefańskiego [2013] i

Wilczek-Jagiełło [2017] jest jednym z najbardziej kosztownych schorzeń w hodowli krów mlecznych, w dużym stopniu ograniczającym jej rentowność. Kulawizna zmniejsza zyski ekonomiczne hodowców [Januś 2018; Michniewicz 2021; Teter i in. 2017].

Skrzypek i in. [2016] wymieniają takie negatywne skutki chorób racic i kończyn w stadach bydła: mniejszą produkcję mleka, gorszą płodność, zwiększoną zachorowalność na mastitis oraz większe brakowanie krów. Choroby palców pogarszają dobrostan zwierząt, wywołując silny i długotrwały ból. Dodatkowymi czynnikami są wydatki na leczenie i czas przeznaczony na obsługę chorych zwierząt [Bach in. 2019].

Badania własne potwierdziły, że kulawizna zwierząt niesie wiele negatywnych skutków dla krów, całego stada oraz dla hodowców, albowiem dochodzi do spadku produkcji mlecznej, brakowania i upadków w stadzie, zakłócenia dobrostanu krów, cierpienia i bólu W opinii ankietowanych choroby racic skutkują zakażeniami, obrzękami, wrzodami i ropniami w okolicach stawów, ścięgien, kręgosłupa, obniżają pobór suchej masy i pasz przez bydło, prowadząc do niewłaściwego odżywiania, generują problemy z rozrodem i zaburzenia płodności oraz skutkują zapaleniem wymienia. Każdego roku brakowanie w stadzie bydła mlecznego wynosi ok. 5-10%. Najwięcej strat ekonomicznych generuje wrzód podeszwy, choroba Montellaro, ochwat i inne schorzenia racic.

Zaniedbane i nieleczone choroby racic mogą skutkować powstawaniem poważnych powikłań, na co zwraca uwagę Karpowicz [2012]. Wczesne wykrycie kulawizny zwiększa prawdopodobieństwo skutecznego wyleczenia, zmniejszenia cierpienia zwierząt i zapobiega dużym stratom finansowym hodowców [Marchewka, Gołębiewski 2018].

Rozpoznanie początkowego etapu pojawiania się kulawizny wymaga wyszkolonego i doświadczonego oka hodowcy, który prawidłowo oceni prawidłowości ruchu zwierząt. Podczas wykrywania nieprawidłowości ważny jest czas reakcji, albowiem im szybciej uda się zdiagnozować problem, tym lepsze są rokowania dla konkretnej sztuki [Chmielewski 2019].

W ostatnich latach w diagnostyce weterynaryjnej coraz częściej stosuje się termowizję. Dzięki możliwości szybkiego, bezinwazyjnego oraz w pełni zautomatyzowanego pomiaru temperatury na powierzchni ciała zwierzęcia, z techniką tą wiąże się duży potencjał w prognozowaniu lokalnych stanów zapalnych, w tym chorób racic [Racewicz i in. 2018].

Leczenie schorzeń racic u krów polega na zakładaniu opatrunków oraz antybiotykoterapii. Z badań własnych wynika, że hodowcy bydła wobec krów z kulawizną podejmują wiele działań. Zabiegi lecznicze obejmują antybiotykoterapię, zakładanie opatrunków, oczyszczanie ran wodą i kwasem salicylowym, odciążanie racicy objętej problemem i usunięcie zmian.

Niezwykle ważna w zapobieganiu i terapii chorób racic krów jest szeroko rozumiana

prewencja weterynaryjna i profilaktyka. Zgodnie z powszechnie znaną zasadą lepiej i taniej jest prowadzić działania profilaktyczne, aniżeli leczyć już istniejące schorzenia, na co zwraca uwagę Zenkner [2021]. Należy zatem zapewnić właściwy poziom dobrostanu oraz odpowiednie warunki sanitarne w odniesieniu do całych stad bydła mlecznego.

Zdaniem Michniewicz [2021] jedynie kompleksowe podejście do problemu, pielęgnacja krów, dbałość o zoptymalizowaną dawkę pokarmową pozwoli na zmniejszenie skali zjawiska i zapewni bydłu zdrowe racice, od których w dużej mierze zależy opłacalność produkcji gospodarstw mleczarskich. Skuteczne eliminowanie kulawizn wymaga wdrożenia określonych procedur postepowania w gospodarstwie w obszarze monitoringu, oceny przyczyn, skali zagrożenia w ramach stada oraz podjęcia jak najszybszego skutecznego leczenia przypadków chorób racic u krów mlecznych. Ważna jest profilaktyka w zakresie pielęgnacji racic, a także poprawa warunków bytowych zwierząt i właściwe żywienie [Teter i in. 2017].

Punktem wyjściowym działań mających na celu utrzymanie wysokiego statusu zdrowotnego racic krów powinna być regularna, codzienna kontrola stanu racic oraz szybkie podejmowanie działań interwencyjnych w celu usunięcia problemu. Ważna jest rutynowa, okresowa korekcja racic, a także fachowa korekcja w razie potrzeby. Przeprowadzenie niezbędnej korekcji albo podjęcie stosownego leczenia bez wątpienia skróci okres powrotu zwierzęcia do pełnej sprawności [Chmielewski 2019].

Wieczorek [2018] zaznacza, że odpowiedni poziom zdrowia racic w stadzie bydła mlecznego wymaga właściwej higieny racic, kąpieli i przycinania. Ważne dla działań profilaktycznych jest ponadto odpowiednie karmienie krów, zapas wody, technologia stosowana w miejscu pobytu zwierząt, ogólny stan ich zdrowia, klimat obory, uwarunkowania genetyczne.

Badania własne potwierdziły te prawidłowości. Rolnicy biorący udział w badaniu podejmują wiele działań o charakterze profilaktycznym w celu zapobiegania chorobom racic u krów mlecznych. Przede wszystkim stosują korekcję racic, kąpiele racic i stosują kwarantanny, jeśli nowa krowa trafia do stada. Część hodowców wykorzystuje odkażające spraye na palce, maty dezynfekujące i aplikuje zwierzętom preparaty doustne. Badani rolnicy do czynników mogących zminimalizować problem występowania chorób racic w stadzie bydła mlecznego zaliczyli: higienę w oborze, higienę i pielęgnację racic, prawidłowe odżywianie, komfort podczas poruszania się zwierząt, odpowiednie powierzchnie do leżenia i stania, czyste i suche legowiska, właściwi system utrzymania zwierząt, regularne usuwanie obornika, spokojne obchodzenie się ze zwierzętami, niestresowanie krów.

Wnioski

1. Choroby racic są bardzo częstymi schorzeniami, jakie dotykają stada krów mlecznych hodowców z terenu powiatu łomżyńskiego. W stadach wszystkich badanych rolników dochodzi do kulawizny utrzymywanych zwierząt, a co za tym idzie, do brakowania stada.
2. Do zachorowań na kulawiznę dochodzi 2-3 razy w roku, o czym wspomniało 58% ankietowanych rolników. Chorobę tę 4-5 razy w roku przechodzą stada 35% respondentów, zaś 3% deklarowało występowanie chorób racic więcej niż 5 razy w roku.
3. Najczęstszą chorobą racic bydła mlecznego zdaniem 68% respondentów jest Zespół Rusterholza (wrzód podeszwy), ochwat (32%), choroba Montellaro (21%), choroba białej linii (17%), najrzadziej występuje zanokcica (14%).
4. Choroby racic bydła mlecznego mają złożoną etiologię. Najczęstszą przyczyną kulawizny są czynniki higieniczne, a zwłaszcza wilgotne stanowiska dla zwierząt, zabłocone wybiegi (78%), system żywienia i nieprawidłowo zbilansowane dawki pokarmowe (67%).
5. Kulawizna zwierząt niesie wiele negatywnych skutków dla krów, całego stada oraz dla hodowców. Skutkuje spadkiem produkcji mleka (85%), brakowaniem i upadkami w stadzie (82%), zakłóceniami w dobrostanie krów (62%), narażeniem zwierząt na ból i cierpienie (56%), niewłaściwym odżywianiem, problemami z rozrodem i zaburzeniami płodności (38%).
6. Hodowcy bydła wobec krów z kulawizną podejmują wiele działań. Zabiegi lecznicze najczęściej obejmują antybiotykoterapię (88%), zakładanie opatrunków (82%), oczyszczanie ran wodą i kwasem salicylowym (68%), odciążanie racicy objętej problemem (56%) i usunięcie zmian (42%).
7. Zapobieganie chorobom racic krów mlecznych wymaga wielu działań o charakterze profilaktycznym. Badani rolnicy jako główne wskazali korekcję racic (87%), kąpiele racic (83%) i stosowanie kwarantanny (56%).

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PORÓWNANIE ROCZNYCH PRZYROSTÓW BIOMASY OXYTREE DO CELÓW ENERGETYCZNYCH PO PIERWSZYM I DRUGIM ROKU WEGETACJI

COMPARISON OF THE ANNUAL INCREASES OF OXYTREE BIOMASS TO ENERGY TARGETS AFTER THE FIRST AND AFTER THE SECOND YEAR OF VEGETATION

Streszczenie

W badaniu realizowanym w latach 2019-2020 na polu doświadczalnym Wyższej Szkoły Agrobiznesu w Łomży (53°10′ N, 22°05′ E) porównano przyrost biomasy drzewa oxytree (P*aulownia clon in vitro 112*) po pierwszym i drugim roku wegetacji. Średnia wysokość pędu po pierwszym roku wegetacji wynosiła 161 cm, przy średniej średnicy pnia 35 mm mierzonej na wysokości 20 cm od powierzchni gruntu. Średnia masa pędu po pierwszym roku wegetacji wynosiła 0,15 kg. Po drugim okresie wegetacyjnym średnia wysokość pędu – 276 cm, średnia średnica pędu mierzona na wysokości 20 cm – 69 mm, średnia masa pędu 1,03 kg. Wartość energetyczna plonu po drugim okresie wegetacyjnym byłą dziesięciokrotnie większa od wartości energetycznej plonu po pierwszym roku wegetacji.
Słowa kluczowe: Oxytree, biomasa, uprawa, ciepło spalania, wartość energetyczna plonu

Summary

T In a study carried out in 2019-2020 in the experimental field of the University of Agribusiness in Łomża (53°10′ N, 22° 05′ E), the increase in the biomass of oxytree (Paulownia

clon invitro 112) after the first and second years of vegetation was compared. The average height of the shoot after the first year of vegetation was 161 cm, while the average diameter of the trunk measured at 20 cm from the ground surface was 35 mm. The average shoot weight after the first year of vegetation was 0.15 kg. After the second growing season, the average height of the shoot - 276 cm, the average diameter of the shoot measured at a height of 20 cm - 69 mm, the average mass of the shoot - 1.03 kg. The energy value of the yield after the second growing season was ten times higher than the energy value of the yield after the first year of vegetation.
Key words: Oxytree, biomass, cultivation, heat of combustion, yield energy value

Wstęp

Przemysł i energetyka oparte na paliwach kopalnych są jednym z głównych źródeł zanieczyszczenia powietrza poprzez emisję CO_2, innych gazów cieplarnianych, jak i degradację gruntów czy wód gruntowych.

W kwietniu 2021 r. odbył się drugi szczyt klimatyczny TOGETAIR. W czasie konferencyjnych paneli były poruszane tematy dotyczące między innym: racjonalnej przyszłość polskiej energetyki i górnictwa, walki za smogiem, zielonej energii, ekologicznego rozwoju rolnictwa, transformacji ciepła systemowego (elektrociepłownie, spalarnie, biomasa).

Wielu autorów w swoich publikacjach naukowych na początku XXI wieku wykazywało, jak można zagospodarować najsłabsze gleby Polski uprawiając rośliny energetyczne przy jednoczesnym ich wykorzystaniu do celów pozyskania ciepła czy energii elektrycznej, co wpisuje się bardzo dobrze w międzynarodowy program energetyczny [Szczukowski i in. 2001; Borkowska, Styk 2003; Faber i in. 2009; Lisowski i in. 2018].

Na przełomie XX i XXI wieku hiszpańscy naukowców z Uniwersytetu Castilla-La Mancha wyhodowali nowy klon mieszańca drzewa Paulownia *(Clon in vitro 112)* uzyskany z dwóch gatunków drzew z rodziny paulowniowatych odmian klonów *Paulownia elongate* i *Paulownia fortunei* [Lisowski, Porwisiak 2020]. Drzewa te, oprócz bardzo szybkiego wzrostu pochłaniają dziesięciokrotnie więcej dwutlenku węgla od naszych drzew rodzimych. Drzewa te mają bardzo małe wymagania glebowe. Można je uprawiać na V a nawet na VI klasie bonitacyjnej przy wodach gruntowych poniżej 2 m. Od roku 2016 w kilku ośrodkach akademickich w Polsce prowadzone są doświadczenia z drzewami oxytree [Jakubowski et al., 2018]. Według informacji od firmy Oxytree Solutions Poland Sp. z o. o. jako jedynego dystrybutora sadzonek oxytree *(Clon in Vitro 112)* na terenie Polski od roku 2016 posadzono ok. 600 ha drzew. Średnio w ciągu roku przybywa ok. 100 ha nowych plantacji produkcyjnych. Głównym celem wszystkich plantacji drzew oxytree jest pozyskanie drewna. Największa plantacja, bo aż 10 ha znajduje się na terenie

woj. lubuskiego. Na terenie Podlasia są również plantacje produkcyjne o powierzchni od 0,5 do 1,5 ha.

Cel, przedmiot i metodyka badań

Celem pracy było porównanie rocznych przyrostów biomasy oxytree (Paulownia Clon in Vitro 112) w pierwszym i drugim okresie wegetacji na doświadczeniu przy Wyższej Szkole Agrobiznesu w Łomży (53°10′ N, 22°05′ E). Dodatkowo wyliczono wartość energetyczną plonu drzew oxytree po pierwszym i drugim okresie wegetacji.

Badania na zawartość popiołu, siarki, węgla, wodoru, wilgoci całkowitej, ciepła spalania przy stałej objętości, wartość opałową przy stały ciśnieniu i przy stałej objętości w drewnie oxytree pochodzącym z jednorocznych pędów drzew wykonano w Energa Elektrownie Ostrołęka S. A. Laboratorium Badań Chemicznych Pracownia Badań Paliw w dniach 11-16.03.2020 r.

Doświadczenie z drzewami oxytree zostało założone w maju 2019 r. Wysadzone zostało 40 sadzonek na powierzchni 700 m2, dostarczonych przez firmę Oxytree Solutions Poland Sp. z o. o. z Wrocławia. Drzewka wysadzono w trzech rzędach:

I rząd 12 szt. odległość w rzędzie 3 lub 4 m,

II rząd 16 szt. odległość w rzędzie 2,5 m,

III rząd 12 szt. odległość w rzędzie 3 i 4 m.

Odległość między rzędami wynosiła 6 m.

Doświadczenie polowe założono na glebie mineralnej, lekkiej. Jesienią 2018 roku pobrano próbki gleby. Badania gleby zostały przeprowadzone przez Okręgową Stację Chemiczno-Rolniczą w Białymstoku. Pomiary temperatury i ilości opadów zostały udostępnione przez Zakład Doświadczalny Oceny Odmian w Marianowie. Zastosowano nawożenie mineralne w ilości 200 kg·ha-1 Polifoski NPKS 8-24-24-9. Teren plantacji doświadczalnej został ogrodzony siatką leśną w celu zabezpieczenia przed dzikimi zwierzętami.

Rozwój drzewek oxytree, na plantacji doświadczalnej, był stale monitorowany. Pomiarom podlegały wysokość drzewek, grubość pnia na wysokości 20 cm. Wykonywano je za pomocą suwmiarki INOX Bucuresti STAS1373-55 0,05 mm, miękka elastyczna taśma miernicza 150 cm FITYLE, oraz listwy pomiarowej THEIS 500 cm/0,1 cm.

W trzeciej dekadzie kwietnia 2020 r. wykonano zabieg polegający na ścięciu jednorocznych pędów na wysokości 5-6 cm od gruntu, jakie wyrosły w pierwszym okresie wegetacyjnym. Pozyskany materiał został zmierzony i zważony.

W pierwszej dekadzie maja 2021 roku stwierdzono przemarznięcie lub wymarznięcie wszystkich pędów po drugim okresie wegetacyjnym. Ze względu na pojawianie się nowych pędów wyrastających z systemu korzeniowego wszystkie pędy, które wyrosły w drugim okresie wegetacyjnym zostały ścięte, zmierzone i zważone.

Nie mierzono i nie ważono ściętych gałęzi, ze względu na ich stosunkowo małe przyrosty w jeszcze zbyt krótkim okresie wegetacji i trudności w dokonaniu dokładnych pomiarów. Jednak ze względu na krótkie cykle produkcyjne użytkować można drewno nie tylko pnia, ale także warto wykorzystywać obcinane w zabiegach pielęgnacyjnych gałęzie. [Jakubowski et al. 2018:293] Jest to drewno niższej wartości do zastosowań przemysłowych, ale warte wykorzystania w uprawach wielkotowarowych, szczególnie do celów energetycznych.

Do obliczenia przyrostów masy oxytree (Paulownia Clon in vitro 112) wykorzystano zależność pomiędzy objętością i masą substancji. Pęd oxytree można opisać jako stożek, a do obliczenia jego objętości wykorzystać wzór matematyczny na obliczenie objętości stożka, tj. $Vs=1/3\ \pi\ r2\ \cdot\ h$.

Suche pędy oxytree przekazano do badań na zawartość siarki, popiołu, węgla, wodoru, ciepła spalania i wartości opałowej w wyniku spalania zrębek tych roślin. Badania zostały wykonane w Energa, Elektrownie Ostrołęka S. A. Laboratorium Badań Chemicznych, Pracownia Badań Paliw. Wartość energetyczną plonu obliczono z iloczynu wartości opałowej przy stałej objętości i jej średniego plonu suchej masy z powierzchni jednego ha w 2019 r.

Wyniki badań

Doświadczenie polowe założono na glebie mineralnej, lekkiej, o odczynie pH w KCl na poziomie 4,4 (bardzo kwaśna). Badania przeprowadzone przez Okręgową Stację Chemiczno-Rolniczą (OSCHR) w Białymstoku, sprawozdanie z dnia 18 października 2018 r., wykazały konieczność wapnowania, natomiast zawartość składników przyswajalnych (makroelementów) zawarta w przebadanych próbkach została określona następująco:

- Fosfor – wysoka;
- Potas - średnia;
- Magnez - wysoka.

Zbadana została również zawartość mikroelementów w glebie. Badania przeprowadzone w OSCHR, określiły następującą zawartość mikroelementów w badanej próbce gleby:

- Bor – niska;
- Mangan – średnia;

- Miedź – średnia;

- Cynk – wysoka;

- Żelazo - średnia.

W roku 2019 w okresie będącym pierwszym okresem wegetacyjnym oxytree w tym doświadczeniu, najcieplejszym miesiącem był czerwiec, ze średnią temperaturą na poziomie 20,4° C, natomiast najzimniejszym miesiącem był kwiecień ze średnią temperaturą 8,6° C (tab. 1).

Tabela. 1. Średnia temperatura miesiąca i suma opadów miesięcznych od kwietnia do października w pierwszym i drugim okresie wegetacyjnym.
Źródło: opracowanie własne na podstawie danych ze Stacji Meteorologicznej Zakładu Doświadczalnego Oceny Odmian w Marianowie

Table. 1. Average temperature of the month and the sum of monthly precipitation from April to October in the first and second growing season
Source: own study based on data from the Meteorological Station of the Variety Assessment Experimental Station in Marianowo

Miesiąc *Months*	**2019**	**2020**	**Średnia temperatura z wielolecia** *Average temperature over many years* 1989-2018 w [° C]	**2019**	**2020**	**Σ opadów z wielolecia** Σ *precipitation from many years* 1989-2018 [mm]
	Średnia temperatura miesiąca. *Average temperature of the month* w [° C]	**Średnia temperatura miesiąca.** *Average temperature of the month* w [° C]		**Σ opadów w miesiącu** *Σ rainfall in a month* w [mm]	**Σ opadów w miesiącu** *Σ rainfall in a month* w [mm	
Kwiecień - *April*	8,6	7,4	8,2	3,7	3,3	35,5
Maj – *May*	12,5	10,1	13,4	116,0	85,0	48,4
Czerwiec – *June*	20,4	16,9	16,5	35,1	188,0	65,6
Lipiec – *July*	17,5	18,0	18,7	106,7	24,4	80,7
Sierpień – *August*	18,5	19,6	18,0	79,9	102,2	62,3
Wrzesień – *September*	13,3	15,7	12,9	41,2	39,0	54,7
Październik – *October*	10,1	11,5	7,8	36,0	53,5	55,5
Średnia temperatura 7- miesięcy *The average tempera of seven months*	14,4	14,2	13,6			
Σ opadów atmosferycznych - ***Σ** atmospheric precipitation*				418,6	495,4	402,7

Średnia temperatura z badanego okresu wynosiła 14,4° C. W odniesieniu do średniej

temperatury wielolecia z lat 1989-2018, która wynosiła 13,6° C, była ona wyższa o 0,8° C.

Opady w roku 2019 kształtowały się następująco: suma opadów atmosferycznych wyniosła 418,6 mm, najwięcej opadów było w maju – 116,0 mm i lipcu – 106,7 mm. Najbardziej suchym miesiącem był kwiecień – 3,7 mm i czerwiec – 35,1 mm (tab. 1)

Analogicznie do poprzedniego okresu wegetacyjnego, średnia temperatura z rozpatrywanego okresu w 2020 wynosiła 14,2° C, najcieplejszym miesiącem był sierpień ze średnią temperaturą rzędu 19,6° C, najzimniejszym miesiącem był kwiecie – 7,4° C i maj ze średnią temperaturą rzędu 10,01° C. Suma opadów atmosferycznych w roku 2020 kształtowała się następująco: suma opadów 495,4 mm, najwięcej opadów było w czerwcu – 188 mm i w sierpniu – 102,2 mm. Najbardziej suchym miesiącem był kwiecień – 3,3 mm, oraz lipiec – 24 mm.

Porównując oba okresy wegetacyjne pod względem czynników abiotycznych mających wpływ na rozwój roślin można zauważyć, że średnie temperatury z badanych okresów są do siebie zbliżone, różnica wynosi 0,09° C, natomiast w odniesieniu do opadów atmosferycznych drugi okres wegetacyjny był obfitszy w opady, różnica wynosi 77 mm na korzyść 2020 r.

W 2020 po pierwszym roku wegetacyjnym średnia wysokość drzew wyniosła 161 cm, przy średniej średnicy pnia drzew na wysokości 20 cm od ziemi wynosiła 35 mm. Średnia ilość pędów wynosiła 2,5 szt. (tab. 2)

Tabela. 2. Wysokość i grubość pnia drzew oxytree po pierwszym i drugim roku wegetacji
Źródło: opracowanie własne

Table. 1. Trunk height and thickness of oxytree trees after the first and second years of vegetation
Source: own study

Rok pomiaru *Year of measurement*	**Średnia wysokość drzew** *Average height of the trees* [cm]	**Grubość pnia** *The thickness of the trunk* [mm]	**Średnia ilość pędów** *Average number of shoots* [szt.]
2020	161	35	2,0
2021	276	69	3,0

Po drugim roku wegetacji średnia wysokość drzew oxytree wynosiła 276 cm przy średniej średnicy pnia 69 mm. Średnia ilość pędów wynosiła 3 szt.

Na podstawie powyższych danych wyliczona została masa m^3 biomasy oxytree.

Obliczenia po pierwszym okresie wegetacji.

Do obliczenia objętości pędu wykorzystany został wzór na objętość stożka.

$V_s=1/3\ \pi\ r^2 * h$ [1.]

Średnia wysokość pędu została pomniejszona o 5 cm, gdyż na takiej wysokości dokonano ścięcia pędów po pierwszym roku wegetacji.

Dane do obliczeń:

H = 156 cm (1560 mm), r = **17,5** mm

$V_{s(oxytree)}= 1/3\ \pi\ (17,5\ mm)^2 * 1560\ mm= 500045\ mm^3 =0,000500045 m^3$

Do obliczeń przyjęto w założeniach na podstawie danych z firmy **Oxytree Solutions Poland sp. z o. o.** z Wrocławia, że gęstość suchego drewna oxytree oscyluje w granicach 300 kg/m^3. Wartość ta wymaga dokładnego określenia dla pozyskanego zbioru ze względu na występujące różnice w zależności od użytych gatunków roślin. Przy wilgotności 12% szeroki przedział gęstości 220-350 kg/m^3 wymienia także Jakubiak et al. [2018:293], natomiast Kozakiewicz [2013:81] optuje za wartością około 270 kg/$m^{3.}$. Badania Kaymakci A., Bektas L., Bal B., [2013] podają wartości wyższe dla drewna *Paulownia elongata* od pozostałych gatunków użytych do klonowania.

Średnia masa suchego pędu oxytree w pierwszym roku wegetacji.

Dane do obliczeń:

- średnia objętość pędu – 0,000500045 m^3
- gęstość suchego drewna oxytree – 300 kg/m^3

1m^3 – 300 kg

0,000500045 m^3 - x

x = 300 kg · 0,000500045 = 0,15 kg

Średnia masa suchego pędu oxytree w pierwszym roku wegetacji wyniosła 0,15 kg.

Obliczenia po drugim okresie wegetacji.

Średnia objętość pędu oxytree w drugim roku wegetacji.

Do obliczenia objętości pędu wykorzystany zostanie wzór na objętość stożka. $V_s=1/3\ \pi\ r^2 * h$

Dane do obliczeń:

Wysokość drzewa mierzona jest od gruntu, w związku z tym, w celu uprawdopodobnienia obliczeń pomniejszona została o 5 cm (wysokość na jakiej zostały ścięte drzewa po drugim okresie wegetacyjnym).

H = 276 cm (2760 mm), r = 34,5mm

$V_{s\ (oxytree)} = 1/3\ \pi\ (34,5mm)^2 * 2760\ mm = 3438394\ mm^3 = 0,003438394 m^3$

Średnia objętość pędu w drugim roku wegetacji wyniosła 0,003438394 m^3 .

Średnia masa pędu oxytree w drugim roku wegetacji:

1 m^3 – 300 kg

0,003438394 m^3 – x

X = 300kg · 0,003438394 = 1,03 kg

Średnia masa pędu oxytree w drugim roku wegetacji wynosi 1,03 kg.

Po pierwszym roku wegetacji, przy średniej masie jednego pędu wynoszącej 0,15 kg, pomnożonej przez 2 (średnia ilości pędów wynikającej z pomiarów) i przy tradycyjnej obsadzie 550 szt. drzew ·ha^{-1} uzyskano 165 kg·ha^{-1} suchego drewna.

Po drugim roku wegetacji, przy średniej masie jednego pędu wynoszącej 1,03 kg pomnożonej przez 3 (średnia ilości pędów wynikającej z pomiarów) i przy tradycyjnej obsadzie 550 szt. drzew ·ha^{-1} uzyskano 1699,5 kg·ha^{-1} suchego drewna.

Rycina 1. Drzewa oxytree w drugim okresie wegetacji. Zdjęcie z dnia 01.09.2020 r.
Fig. 1. ***Oxytree trees in the second growing season. Photo from 01/09/2020***

W lutym i marcu 2020 r. wykonano badanie w Certyfikowanym Laboratorium Elektrowni w Ostrołęce na zawartość węgla, wodoru, popiołu, siarki, ciepła spalania i wartości opałowej z jednorocznych pędów oxytree. Wyniki przedstawiono w tabeli 3.

Tabela. 3. Wyniki badań zrębek z jednorocznych pędów oxytree w wyniku spalania
Źródło: opracowanie własne na podstawie sprawozdania z Laboratorium Badań Chemicznych Energa luty-marzec 2020

Table. 3. Results of research on wood chips from one-year-old oxytree shoots as a result of combustion
Source: own study based on the report from the Energa Chemical Research Laboratory, February-March 2020

Wyszczególnienie - *specification*	**Jednostka miary** *Unit of measure*	**Wartości energetyczne** *Energy values*
Wilgotność robocza - *Working humidity*	%	7,9
Zawartość węgla - *Carbon content*	%	46,4
Zawartość wodoru- *Hydrogen content*	%	5,61
Zawartość popiołu- *Ash content*	%	1,9
Zawartość siarki- *Sulfur content*	%	0,03
Wartość opałowa przy stałej objętości *Calorific value at constant volume*	KJ/kg	16777
Ciepło spalania przy stałej objętości *Combustion heat at constant volume*	KJ/kg	18114

W wyniku spalania jednorocznych pędów oxytree, badanie wykazało bardzo małą zawartość popiołu i siarki. Zawartość procentowa popiołu i siarki była w podobnych bardzo niskich wartościach w ślazowcu pensylwańskim (*Sida hermaphrodita* Rusby) i miskancie olbrzymim (*Miscanthus sinensis giganteus*) co wykazali Tworkowski i in. [2014] oraz Lisowski i Borusiewicz [2019]. Również wartość opałowa i ciepło spalania były o zbliżonych wartościach.

Tabela. 4. Plon drewna i wartość energetyczna plony pędów oxytree po pierwszym i drugim okresie wegetacji
Źródło: opracowanie własne

Table. 4. Wood yield and energy value of oxytree shoots yield after the first and second growing season
Source: own study

Plon drewna po pierwszym roku wegetacji *Wood yield after the first year of vegetation* [t·ha^{-1}]	**Wartość energetyczna plonu po pierwszym roku wegetacji** *The energy value of the yield after the first year of vegetation* [GJ·kg^{-1}]	**Plon drewna po drugim roku wegetacji** *Wood yield after the second year of vegetation* [t·ha^{-1}]	**Wartość energetyczna plonu po drugim roku wegetacji** *The energy value of the yield after the second year of vegetation* [GJ·kg^{-1}]
0,165	2,768	1,699	28,504

Wartość energetyczna plonu uzależniona jest od dwóch parametrów: pierwszym parametrem jest plon suchej masy, a drugim wartość opałowa. W wyniku spalania pędów oxytree po drugim okresie wegetacyjnym wartość energetyczna plonu była dziesięciokrotnie większa od wartości energetycznej plonu pędów oxytree po pierwszym roku wegetacji.

Podsumowanie

Celem tego opracowania jest porównanie przyrostu biomasy drzewa oxytree po pierwszym i drugim roku wegetacji. Jak wynika z pomiarów i obliczeń drzewo oxytree po drugim roku wegetacji zwiększa dziesięciokrotnie produkcję biomasy. Przy takich parametrach wzrostu jako roślina, której biomasę można przeznaczyć na cele energetyczne, jest doskonałą alternatywą dla biomasy leśnej pozyskiwanej na cele energetyczne. Uprawa oxytree z przeznaczeniem na cele energetyczne, pozwoli w dużej mierze ograniczyć eksploatację polskich lasów, z drugiej zaś strony, z racji niskich wymagań glebowych, może być wykorzystywana jako roślina do zasiedlenia nieużytków lub do rekultywacji terenów zdegradowanych. Dużym utrudnieniem będą wysokie koszty sadzonek i przygotowania uprawy. Bezwzględna korzyścią pozostanie bardzo wysoka produkcja tlenu do atmosfery.

Warunki klimatyczne w jakich przeprowadzone zostało doświadczenie były sprzyjające rozwojowi drzew oxytree. Średnia temperatura w badanym okresie (kwiecień-październik) 2019 r. i 2020 r. była wyższa od średniorocznej temperatury analogicznego okresu wielolecia (1989-2018) i wynosiła odpowiednio w 2019 r. – 14,4^{o} C i 14,2^{o} C.

Suma opadów dla badanych okresów również była wyższa niż suma opadów wielolecia i kształtowała się następująco – w 2019 r. wynosiła 418,6 mm, natomiast w 2020 roku wynosiła 495,4 mm.

Według Lisowskiego i Porwisiaka [2017] oraz Lopeza [2015], warunki klimatyczne mają wpływ na rozwój drzewa oxytree, nie mniej posiada ono dużą zdolność adaptacji i w nawet częściowo niekorzystnych warunkach zachowuje swoje zdolności rozwojowe.

Warto zwrócić uwagę na korzyści jakie płyną z uprawy oxytree. Przede wszystkim cechy biometryczne drzewa, szybki przyrost biomasy jakim się charakteryzuje dają możliwość relatywnie szybkiego zwrotu nakładów, jakie należy ponieść na założenie plantacji. Oddziaływanie proekologiczne dopełnia zestawu pozytywnych walorów tej rośliny.

Wnioski

Na podstawie przeprowadzonego doświadczenia na polu doświadczalnym WSA Łomża w dwóch okresach wegetacyjnych dotyczące pozyskania biomasy z drewna oxytree oraz wartości energetycznej plonu można sformułować następujące wnioski:

1. Po drugim roku wegetacji drzew oxytree plon biomasy suchego drewna oxytree wynosił 1699,5 kg·ha^{-1} i był prawie dziesięciokrotnie większy w stosunku do plonu biomasy po

pierwszym roku wegetacji.

2. W wyniku spalania zrębków jednorocznych pędów oxytree zawartość popiołu, siarki przy wilgotności 7,9% jest bardzo niska i wynosiła odpowiednio 1,9% i 0,03%.
3. Wartość opałowa i ciepło spalania jest tylko ok. 30% mniejsze od spalanego w elektrowniach w Polsce węgla.
4. Niskie temperatury powietrza utrzymujące się w maju 2020 roku oraz niesprzyjający rozkład opadów w obydwu okresach wegetacyjnych mógł mieć wpływ na plon biomasy z oxytree.

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PORÓWNANIE PLONOWANIA TRZECH ODMIAN SOI W DWÓCH OKRESACH WEGETACYJNYCH

COMPARISON OF THE YIELD OF THREE SOYA VARIETIES IN TWO VEGETATION PERIODS

Streszczenie

W badaniach realizowanych w latach 2020-2021 w Stacji Doświadczalnej w Marianowie porównano plonowanie 3 odmian soi należących do grupy bardzo wczesnych i wczesnych: Erica, Adessa i Antigua. Celem pracy była analiza plonu soi. Uzyskane wyniki wykazują, że czynniki klimatyczne najsilniej oddziaływały na wielkość plonu nasion soi. W pracy porównano plony z dwóch lat uprawy. W 2020 roku najlepiej plonowała odmiana Erica, a w 2021 roku odmiana Adessa. Plony odmian w 2020 roku dla odmian Erica, Adessa i Antigua wynosiły kolejno: 21,93 dt · ha^{-1}; 18,78 dt · ha^{-1}; 20,3 dt · ha^{-1}. Wszystkie odmiany osiągnęły wyższe plony w 2021 roku. Uzyskały kolejno: 27,15 dt · ha^{-1}; 29,45 dt · ha^{-1}; 28,3 dt · ha^{-1}. Średni plon trzech odmian soi w 2021 roku był wyższy od średniego plonu tych samych trzech odmian soi w roku 2020 o 39%.

Słowa kluczowe: soja, plonowanie, odmiana, uprawa, pielęgnacja, nawożenie

Summary

In studies carried out in 2020-2021 at the Experimental Station In Marianów, the yield of 3 soybean varieties belonging to the very early and early group was compared: Erica, Adessa and Antigua. The aim of the study was to analyze the soybean yield. The obtained results show that

climatic factors had the strongest impact on the yield of soybeans. The work compares the yields from two years of cultivation. In 2020, the cultivar Erica produced the best, and in 2021, cultivar Adessa. The cultivar yields in 2020 for the cultivars Erica, Adessa and Antigua were respectively: 21.93 dt · ha^{-1}; 18.78 dt · ha^{-1}; 20.3 dt · ha^{-1}. All varieties achieved higher yields in 2021. They obtained successively: 27.15 dt · ha^{-1} ; 29.45 ; dt · ha^{-1}; 28.3 dt · ha^{-1} . The average yield of the three soybean varieties in 2021 was higher than the average yield of the same three soybean varieties in 2020 by 39%.
Key words: soybean, yielding, variety, cultivation, care, fertilization

Wstęp

Rodzina roślin bobowatych obejmuje zarówno rośliny jednoroczne, wieloletnie, a także drzewa, krzewy, zioła, liany i rośliny wodne. Są one rozprzestrzenione na całym świecie w bardzo zróżnicowanych strefach klimatycznych. Ze względu na masę tysiąca nasion rośliny bobowate dzielimy na grubonasienne i drobnonasienne. Pierwsza grupa, czyli rośliny bobowate grubonasienne to gatunki jednoroczne, które uprawia się głównie z przeznaczeniem na nasiona, ale również uzupełniająco na zieloną masę [Kotecki (red.), 2020].

Soja jest rośliną oleistą numer jeden, stanowiącą 60% światowej produkcji nasion oleistych. Jej nasiona są bogate zarówno w białko, jak i olej. Białko nasion soi składa się z 18 aminokwasów, w tym wszystkich 10 aminokwasów niezbędnych. Olej sojowy jest bogaty w nienasycone kwasy tłuszczowe Zawartość składu nasion ma uderzający wpływ na jakość i zastosowanie produktów sojowych, takich jak mączka białkowa i olej do pieczenia [Zhang i inni, 2018].

Najwięksi producenci soi, czyli USA, Ameryka Południowa i Chiny, pochodzą z regionu Pacyfiku. Wzrastająca świadomość na temat korzyści zdrowotnych, jakie niesie za sobą spożywanie żywności na bazie soi, a także wiedza o alergiach spowodowanych mlekiem oraz próba większego zrównoważenia produkcji żywości sprawiły, że wzrasta liczba dostępnych produktów na bazie tej rośliny [Coletti i inni, 2020].

Jedną z najcenniejszych, a także najpowszechniej uprawianych na świecie jest niewątpliwie soja. O jej dużym znaczeniu gospodarczym świadczy rola jaką pełni w światowej produkcji. Zawdzięcza to wysokiej zawartości białka i tłuszczu, a także pozytywnym wpływie na glebę i rośliny następcze. Aktualnie soja, jako roślina uprawna, nie odgrywa aż tak ważnej roli w Polsce. Natomiast produkty jej przerobu, m.in. olej i śruta sojowa mają już znacznie większe znaczenie gospodarcze, niestety większość produktów sojowych jest importowana, co jest spowodowane deficytem komponentów białkowych w naszym kraju [Boczar, 2016].

Rosnące zainteresowanie uprawą soi szczególnie w strefie klimatu umiarkowanego, wymusza dążenie do znalezienia odmian wysokoplennych o optymalnym okresie wegetacji. W Europie zalecana jest uprawa głównie odmian wczesnych i bardzo wczesnych [Rębilas i inni, 2020].

Soja jest postrzegana jako podstawowa roślina białkowa, użytkowana jako pokarm dla ludzi i cenna pasza dla zwierząt. Ten gatunek uprawia się głównie na nasiona, ale niekiedy także na zieloną paszę, zazwyczaj w mieszankach na przykład z sorgiem lub kukurydzą. W grupie roślin bobowatych to właśnie soja jest deklasującym pozostałe gatunki liderem [Lewandowska, 2019]. W tabeli 1 przedstawiono powierzchnię uprawy oraz plony i zbiory soi na świecie.

Tabela. 1. Powierzchnia uprawy, plon i zbiory soi na świecie w latach 1961-2019
Źródło: opracowanie własne na podstawie danych z FAOSTAT 2021

Table. 1. Soybean cultivation area, yield and harvest in the world in 1961-2019
Source: own study based on data from FAOSTAT 2021

Lata *Years*	Powierzchnia uprawy *Cultivation area* [mln ha]	Plon *crop* [t·ha^{-1}]	Zbiór soi *soybean harvest* [mln t]
1961	23,8	1,13	26,9
1971	30,0	1,52	45,6
1981	50,5	1,75	88,5
1991	55,5	1,87	102,8
2001	76,8	2,31	177,0
2011	103,6	2,52	261,6
2015	120,9	2,67	323,3
2016	122,0	2,75	335,9
2017	125,9	2,86	359,5
2018	124,0	2,78	344,6
2019	120,5	2,77	333,7

Każdego roku można zaobserwować wzrost zainteresowania uprawą tej cennej rośliny także w Europie. Według Koteckiego [2020] do głównych europejskich producentów nasion zaliczamy Ukrainę i Rosję, a pośród krajów UE: Włochy, Serbię, Rumunię i Francję (tabela 2).

Zwiększony udział soi w strukturze zasiewów roślin bobowatych może być spowodowany jej mniejszym zapotrzebowaniem na nawożenie mineralne, a w związku z tym również mniejszy koszt uprawy, a jest to jeden z głównych czynników którymi kierują się rolnicy [Adamska i inni, 2017].

Podczas kalkulacji opłacalności uprawy roślin strączkowych, w tym soi nie uwzględnia się korzyści, które oddziaływają na glebę i plon roślin następczych. Po uprawie roślin bobowatych w uprawie roślin następczych występuje potencjalny wzrost plonu, możliwość zmniejszenia dawki azotu, kosztów pestycydów oraz kosztów uprawy gleby w kolejnych latach.

Należy pamiętać, że azot pozostawiony przez rośliny strączkowe nie jest trwale związany w glebie. Gdy roślina następcza nie będzie w stanie go efektywnie wykorzystać, wówczas może dojść do wymycia tego pierwiastka.

Tabela. 2. Powierzchnia uprawy, plon i zbiór soi w Polsce w 2019 na tle krajów europejskich
Źródło: opracowanie własne na podstawie danych z FAOSTAT 2021

Table. 2. Soybean cultivation area, yield and harvest in Poland in 2019 compared to other European countries
Source: own study based on data from FAOSTAT 2021

Kraj *country*	Powierzchnia uprawy *Cultivation area* [tys. ha]	Plon *crop* [t·ha^{-1}]	Zbiór soi *soybean harvest* [tys. t]
UE - *EU*	907,9	3,10	2813,3
Rosja - *Russia*	277,2	4,36	1572,7
Włochy - *Italy*	273,3	3,81	1042,8
Serbia - *Serbia*	229,4	3,05	700,5
Francja - *France*	163,8	2,61	428,5
Ukraina - *Ukraine*	161,3	2,30	369,9
Rumunia - *Romania*	158,2	2,78	440,1
Polska - *Poland*	7,92	2,00	155,4

Kolejnym problemem jest niewielka ilość substancji do odchwaszczania roślin strączkowych, co w rezultacie może prowadzić do nasilenia problemów ze szkodnikami i chorobami. Ponadto niska cena oraz problem ze sprzedażą mniejszych partii nasion może zniechęcać dużą grupę potencjalnych producentów [Walerowska, 2018].

Cel, przedmiot i metodyka badań

Celem doświadczenia było porównanie wpływu czynnika odmianowego na plonowanie trzech odmian soi (Adessa, Antigua, Erica) należących do wczesnych w warunkach Polski północno-wschodniej, w latach 2020-2021. Materiał badawczy w 2020 i 2021 roku pochodził z poletek doświadczalnych zlokalizowanych przy Zakładzie Doświadczalnym Oceny Odmian w Marianowie (53º13´ N, 22º07´ E).

Doświadczenie polowe proste przeprowadzono w trzech powtórzeniach na poletkach o powierzchni 19,5 m^2. Powierzchnia poletek przy zbiorze wynosiła 16,5 m^2. Doświadczenie w 2020 roku założono na glebie brunatnej właściwej, kompleksu żytniego bardzo dobrego, klasy IVa na stanowisku po ziemniaku. W 2021 roku, doświadczenie zostało założone na glebie brunatnej wyługowanej z pyłu zwykłego i piasku słabo gliniastego na glinie lekkiej, kompleksu żytniego dobrego, klasy IVa.

Masa tysiąca nasion soi dla badanych odmian w 2020 roku, (Erica, Adessa i Antigua) wynosiła kolejno: 177 g; 191,7 g; 189 g, a ich zdolność kiełkowania 96%, 95%, 87%. W roku 2021 MTN dla badanych tych samych odmian soi przed wysiewem wynosiła kolejno: 184 g; 186 g; 234 g, a ich zdolność kiełkowania 92%. W obu okresach wegetacyjnych pod uprawę soi zastosowano jednorazowo nawożenie przedsiewne (tabela 3). Nasiona przed siewem zaprawiono nitraginą przy pomocy HiStick Soy. W jednym i drugim okresie wegetacji w czerwcu wykonano zabieg ochrony roślin przy pomocy herbicydu Corum 502,4 SL w dawce 1,25 $l \cdot ha^{-1}$.

Tabela. 3. Warunki doświadczenia w roku 2020 i 2021
Źródło: opracowanie własne na podstawie danych udostępnionych przez ZDOO w Marianowie

Table. 3. Experimental conditions in 2020 and 2021
Source: own elaboration based on data provided by ZDOO in Marianowo

rok *year*	**Kompleks glebowy** *Soil complex*	**Klasa bonitacyjna** *Survey class*	**pH gleby** *soil pH*	**Nawożenie mineralne** *Mineral Fertilization* [$kg \cdot ha^{-1}$]	**Termin siewu** *Sowing date*	**Termin zbioru** *Harvest date*
2020	3	IVa	5,3	N-12,5 P-16,3 K-74,7	4 maj	22.10.2020
2021	5	IVa	6,4	N-18,0 P- 15,7 K- 84,7	11 maj	08.10.2021

Próby gleby na zawartość makroelementów i pH były pobrane z poetek i przekazane do Okręgowej Stacji Chemiczno-Rolniczej w Białymstoku. Dane dotyczące warunków klimatycznych zostały pozyskane ze stacji meteorologicznej przy ZDOO Marianowo.

Wyniki badań

Zasobność gleby w latach 2020 i 2021 nieznacznie się różniła. Wyniki badań gleby przeprowadzonych w 2020 roku pokazały wysoką zasobność fosforu, średnią potasu, niską magnezu oraz kwaśny odczyn gleby.

Tabela. 4. Odczyn gleby i jej zasobność w przyswajalne makroskładniki pokarmowe
Źródło: opracowanie własne na podstawie danych udostępnionych przez ZDOO w Marianowie

Table. 4. ***The pH of the soil and its abundance in digestible macronutrients***
Source: own elaboration based on data provided by ZDOO in Marianowo

Rok *year*	**pH w KCl** *pH in KCl*	**Zawartość składników pokarmowych** *Nutrient content* [g·kg^{-1}]		
		fosfor *phosphorus*	**potas** *potassium*	**magnez** *magnesium*
2020	5,3	19,7	13,1	3,3
2021	6,4	18,8	11,9	3,7

Zasobność gleby oznaczonej w 2021 roku wykazała wysoką zawartość fosforu, średnią magnezu i potasu oraz lekko – kwaśny odczyn gleby.

Średnia roczna temperatura w 2020 i 2021 roku z siedmiu miesięcy różniła się zaledwie o 0,9° C. Średnia dobowa temperatura z siedmiu miesięcy w roku 2020 była niższa od średniej dobowej z wielolecia w tych samych miesiącach o 0,1° C natomiast w roku 2021 była ona wyższa o 0.8° C . Suma opadów w roku 2020 na przełomie miesięcy kwiecień – październik była wyższa o 61 mm od sumy opadów z wielolecia natomiast w roku 2021 była niższa o 10,8 mm od sumy opadów z wielolecia 2010 – 2019 (tabela 5).

Tabela. 5. Średnia temperatura oraz suma i rozkład opadów w latach 2020 i 2021
Źródło: opracowanie własne

Table. 5. Average temperature, sum and distribution of precipitation in 2020 and 2021
Source: own study

Miesiąc month	**Temperatura** - *Temperature* [° C]			**Opady** - *Rainfall* [mm]		
	2020	2021	**Wielolecie** *Many years (2010 – 2019)*	2020	2021	**Wielolecie** - *Many years (2010 – 2019)*
IV	7,4	6,4	8,4	3,3	30,1	35,1
V	10,1	11,5	13,8	85,0	72,8	70,6
VI	16,9	18,7	17,3	188,0	52,7	59,4
VII	18,0	22,0	18,5	24,4	127,0	107,1
VIII	19,6	17,0	18,7	102,2	89,9	65,4
IX	15,7	12,4	13,4	39,0	40,2	55,1
X	11,5	8,6	7,5	53,5	10,9	41,7
Średnia temp. *Average temp*	13,8	14,7	13,9	-	-	-
Suma opadów - *Total rainfall*				495,4	423,6	434,4

W kwietniu 2021 roku temperatura była niższa od kwietnia 2020 roku o 1,0° C oraz o 2,0° C w porównaniu do kwietnia z dziesięciolecia. Temperatury w maju były niższe, zarówno w maju 2020 i 2021 w zestawieniu ze średnią temperaturą tego miesiąca z ostatnich 10 lat. Natomiast w dwóch kolejnych miesiącach, czyli czerwcu i lipcu, najwyższe temperatury zanotowano w 2021 roku. Najcieplejszym miesiącem był lipiec, którego średnia miesięczna temperatura wyniosła 22,0° C i była wyższa o 3,0° C od lipca z roku poprzedniego oraz o 3,5° C od średniej temperatury

lipca w wieloleciu. Sierpień i wrzesień w 2020 roku wykazały się wyższa średnią miesięczną temperaturą w porównaniu do analogicznych miesięcy z roku 2021 i wielolecia. Natomiast październik w roku 2021 był chłodniejszy, niż w 2020 roku o 2,9^{o} C i cieplejszy o 4,0^{o} C od października z wielolecia.

Kwiecień 2020 był bardzo suchy, występowały jedynie przelotne mżawki, które finalnie dały sumę opadów na poziomie 3,3 mm, znacznie niższą w porównaniu do 2021 roku oraz wielolecia. Z kolei w maju 2020 i 2021 roku ilości opadów były zbliżone do opadów z wielolecia. Czerwiec 2020 roku charakteryzował się ulewnymi deszczami, różnica pomiędzy rokiem 2021 i wielolecia była wyższa odpowiedni o ż o 135,3 mm i 128,6 mm. W lipcu 2021 roku w porównaniu z rokiem 2020 ilość opadów atmosferycznych była wyższa o 102,6 mm. Natomiast wrzesień nie był bardzo zróżnicowany pod względem opadów w roku 2020 i 2021.

W 2021 roku porównywane odmiany soi szybciej osiągały dojrzałość techniczną oraz pełną. Największa różnica wystąpiła w przypadku odmiany Adessa, gdzie okres ten skrócił się o 16 dni przy osiągnięciu dojrzałości technicznej i 17 dni przy osiągnięciu dojrzałości pełnej. Najmniejszą różnicą odznaczała się odmiana Erica, której czas od siewu do dojrzałości technicznej skrócił się o 7 dni, a czas do dojrzałości pełnej o 9 dni (tabela 6).

Tabela. 6. Średnia liczba dni od siewu do dojrzałości technicznej i pełnej w zależności od odmiany
Źródło: opracowanie własne na podstawie danych udostępnionych przez ZDOO w Marianowie

Table. 6. Average number of days from sowing to technical and full maturity depending on the variety
Source: own elaboration based on data provided by ZDOO in Marianowo

Odmiana variety	**Dojrzałość techniczna (liczba dni)** *Technical maturity (number of days)*		**Dojrzałość pełna (liczba dni)** *Full maturity (number of days)*	
	2020	2021	2020	2021
Erica	131	124	135	126
Adessa	138	122	141	124
Antigua	136	123	140	126

W 2021 roku średnia wysokość roślin była zauważalnie większa w porównaniu do roku 2020. Wysokość odmian Erica i Antigua wzrosła o 44 cm, natomiast największa różnica była w przypadku odmiany Adessa, gdzie ta różnica wyniosła aż 51,67 cm (tabela 7).

Tabela. 7. Średnia wysokość roślin (cm) w zależności od odmiany
Źródło: opracowanie własne na podstawie danych udostępnionych przez ZDOO w Marianowie

Table. 7. Average plant height (cm) depending on the variety
Source: own elaboration based on data provided by ZDOO in Marianowo

Odmiana variety	**Wysokość roślin** - *Plant height* [cm]	
	2020	**2021**
Erica	75,33	119,33
Adessa	69,33	121,00
Antigua	72,00	116,00

Rok 2021 był znacznie korzystniejszy dla wszystkich odmian pod względem ilości zebranych plonów. Najlepiej plonującą odmianą w 2021 roku była Adessa, która zwiększyła swój plon o 1,76 kg z poletka i 10,67 $dt \cdot ha^{-1}$ w porównaniu do roku 2020, gdzie była najsłabiej plonującą odmianą.

Tabela. 8. Plon zebranych nasion soi w zależności od odmiany
Źródło: opracowanie własne na podstawie danych udostępnionych przez ZDOO w Marianowie

Table. 8. Yield of harvested soybeans depending on the variety
Source: own elaboration based on data provided by ZDOO in Marianowo

Odmiana variety	**Plon (kg/poletko)**- *Yield (kg / plot)*		**Plon** - *yield* ($dt \cdot ha^{-1}$)	
	2020 rok/*2020 year*	**2021 rok**/*2021 year*	**2020 rok**/*2020 year*	**2021 rok**/*2020 year*
Erica	3,62	4,48	21,93	27,15
Adessa	3,10	4,86	18,78	29,45
Antigua	3,35	4,67	20,30	28,30
Plon średni *Average yield*	3,36	4,67	20,34	28,30

Najmniejszą różnicę, a zarazem największą równość plonowania wykazała odmiana Erica, która plonowała lepiej o 0,86 kg z poletka i 5,25 $dt \cdot ha^{-1}$, a w 2020 roku była najlepiej plonującą odmianą. Odmiana Antigua w porównaniu do pozostałych odmian plonowała, na średnim poziomie z zwiększając swój plon o 1,32 kg z poletka i 8 $dt \cdot ha^{-1}$ w porównaniu do pozostałych odmian, zarówno w 2020, jak i w 2021 roku. Średni plon trzech odmian soi w 2021 roku był wyższy od średniego plonu tych samych trzech odmian soi w roku 2020 o 39%.

Podsumowanie

Głównym czynnikiem, który determinuje wielkość otrzymanych plonów są warunki klimatyczne a w szczególności przebieg temperatur w ciągu okresu wegetacyjnego oraz rozkład opadów atmosferycznych w konkretnych fazach rozwoju roślin. Układ warunków atmosferycznych w 2021 roku był zdecydowanie korzystniejszy, niż w roku 2020 dla uprawy soi. Niższe temperatury w kwietniu opóźniły siew soi szczególnie w 2021 roku, jednak kluczowym miesiącem w procesie kształtowania się plonu możemy określić miesiąc lipiec w którym średnia

dobowa temperatura oraz suma opadów była zdecydowanie wyższa w porównaniu zarówno do roku 2020 i średniej wieloletniej. Według Borosa i innych [2021] to właśnie miesiąc lipiec jest przełomowy, gdyż wtedy nasiona i strąki są w pełni wykształcone, a warunki atmosferyczne mają największy wpływ na wszelkie oceniane cechy nasion. Niskie opady przy średniej temperaturze wyższej niż średnia wieloletnia mają znacząco negatywne oddziaływanie. Również Biel i inni [2017] uważają, że uprawa soi w Polsce wiąże się ze znacznym ryzykiem, gdyż jest ona rośliną ciepłolubną oraz szczególnie wrażliwą na niesprzyjające czynniki środowiska. Z tego powodu uzyskany plon różni się zarówno od miejsca wzrostu i roku przeprowadzonego badania.

Szczerba i inni [2021] twierdzą, iż dobór odmiany soi na podstawie długości okresu wegetacyjnego i jej zdolności do kiełkowanie w niższych temperaturach pozwala na jej wcześniejszy siew, a w rezultacie gwarancję wcześniejszego zbioru nasion. Jednakże, mimo doboru wczesnych odmian soi, a także wcześniejszego siewu w 2020 roku, jej zbioru dokonano znacznie później, niż roku 2021. Było to wynikiem niższej temperatury w czasie wykształcania nasion. Wysokie temperatury w miesiącach maj – lipiec oraz wystarczające opady w maju i czerwcu oraz bardzo obfite w lipcu skróciły okres wegetacji i przyspieszyły zbiory w 2021 roku. Ustalenia Rattalino Edreira i innych [2017] potwierdzają, że reakcja soi na późniejszy siew jest uzależniona od sumy opadów w czasie formowania strąków. Natomiast Pierozan Junior i inni [2017] w swych badaniach wywnioskowali, iż należy podzielić odmiany soi na takie, które można polecać do wczesnego siewu i inne, które są zalecane do opóźnionego. Na tej podstawie moglibyśmy oceniać, iż dla soi należącej do grupy odmian bardzo wczesnych i wczesnych opóźnienie terminu może prowadzić do zwiększenia plonu. Z kolei Mourtzinis i inni [2019] twierdzą, iż optymalny termin siewu soi jest zależny od klimatu określonego rejonu, gdzie będzie ona uprawiana.

Uwagę należy zwrócić również na stanowiska, na których zostały wysiane nasiona soi. Rok 2020 charakteryzował się niską zasobnością gleby w magnez i kwaśnym odczynem, natomiast 2021 odczynem lekko – kwaśnym oraz średnią zasobnością magnezu w podłożu. Soja jest rośliną wymagającą odczynu obojętnego, bądź zbliżonego do niego, gdyż wiąże się to z możliwością wiązania azotu, jest również wrażliwa na niedobory magnezu. Oprócz warunków meteorologicznych, również ten czynnik mógł odpowiadać za niższe plony w 2020 roku, co potwierdzają badania Jareckiego i innych [2019], które dowodzą, że to dobór odmiany soi do właściwego stanowiska i rejonu są sposobem na otrzymanie satysfakcjonujących plonów soi.

Wnioski

1. Średni plon trzech odmian soi w 2021 roku był wyższy od średniego plonu tych samych trzech odmian soi w 2020 roku o 39%.
2. Przebieg temperatury w poszczególnych miesiącach oraz ilość i rozkład opadów jest głównym czynnikiem odpowiadającym za plonowanie soi. Odmiana soi Adessa była zarazem najlepiej plonującą odmianą w sprzyjających warunkach w roku 2021 (29,45 dt · ha^{-1}), a także najgorzej w niesprzyjających w 2020 r. (18,78 dt · ha^{-1})
3. Czynnikiem determinującym ilość dni koniecznych do osiągnięcia zarówno dojrzałości technicznej oraz pełnej są warunki atmosferyczne podczas okresu wegetacji.

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TECHNIKI ROLNICTWA PRECYZYJNEGO

PRECISION FARMING TECHNIQUES

Streszczenie

Rolnictwo precyzyjne to koncepcja technologiczna, będąca istotnym elementem realizacji zrównoważonego rozwoju, w związku z tym od użytkownika wymaga specjalnych kwalifikacji, bez których osiągnięcie korzyści nie byłoby możliwe. Jak wykazały badania system prowadzenia John DEERE Premium dla właściciela gospodarstwa to zwiększenie wydajności maszyn, poprawa jakości upraw i plonów, przy jednoczesnym zmniejszeniu eksploatacji i zwiększeniu komfortu jego pracy. Zakup kombajnu John Deere T660 to inwestycja, która pozwoli na zbiór w gospodarstwie w optymalnym terminie i powinna się zamortyzować po 7 latach. Dla właściciela badanego gospodarstwa wdrożenie rolnictwa precyzyjnego to:

- oszczędność na środkach ochrony roślin 4%,
- na nawozach mineralnych 6%,
- na materiale siewnym 4%,
- na paliwie 5%.

Słowa kluczowe: rolnictwo, rolnictwo precyzyjne, system nawigacji satelitarnej, nowoczesne technologie

Summary

Precision agriculture is a technological concept that is an important implementation of

sustainable development. Therefore the user requires special qualifications without which benefits would not be possible. Research has shown that the John Deere Premium guidance system for the farm owner increases the yield of machines, improves the quality of crops and crops, reduces operation, and increases his work's comfort. The purchase of the John Deere T660 combine is an investment that will allow you to harvest on the farm in the optimal time and should pay for itself after 7 years. For the owner of the researched farm, the implementation of precision farming means:

- savings on plant protection products 4%,
- on mineral fertilizers 6%,
- on seed 4%,
- on fuel 5%.

Key words: agriculture, precision farming, satellite navigation system, modern technologies

Wstęp

Rolnictwo precyzyjne (ang. Precision Farming, Precision Agriculture) to zespół technologii tworzących system rolniczy dostosowujący wszystkie elementy agrotechniki do zmiennych warunków panujących na polach uprawnych [Wawrzynowicz i in. 2012]. Rolnictwo precyzyjne jest również definiowane jako gospodarowanie wspomagane komputerowo, które opiera się przede wszystkim na gromadzeniu danych o przestrzennym zróżnicowaniu plonów w obrębie pola [Jadczyszyn 1998].

Jest to gospodarowanie z zastosowaniem technologii informatycznych celem uzyskania wyższych i lepszej jakości plonów przy równoczesnym obniżeniu kosztów produkcji i minimalizacji negatywnego oddziaływania na środowiska [Izdebski i in. 2016; Walaszczyk 2017].

Nowoczesny system, na którym opiera się rolnictwo precyzyjne, polega na tym, że maszyny rolnicze są wyposażone w specjalny miernik plonów i korzystają z satelitarnego referencyjnego systemu globalnego pozycjonowanie (zbierają dane z pola) [Chotkowski 2012].

Niezbędnym narzędziem rolnictwa precyzyjnego jest sprzęt do pobierania próbek. Pozyskane dane są potem przenoszone do komputera, po czym, po przetworzeniu ich przez program zostaną odzwierciedlone na barwnej mapie plonów. Dzięki temu można bezbłędnie oszacować wielkość zbiorów a na podstawie analizy glebowej stworzyć cyfrową mapę zasobności gleby w makro- i mikroelementy, a także jej zmienności odczynowej. W efekcie tego zabiegi agrotechniczne są precyzyjnie dostosowane do zróżnicowania czynników w danym obszarze na polu. Za pomocą takich technologii można także:

- szczegółowo ustawić częstotliwość i dawki stosowania ŚOR,

- uzyskać plony większe i lepszej jakości obniżając jednocześnie koszty produkcji [Kozera i in. 2012].

Rolnictwo precyzyjne wymaga od rolników odpowiednich kwalifikacji, dużego zaangażowania intelektualnego i nieustannego śledzenia nowości technologicznych. Związane jest też z dużymi kosztami, dlatego najłatwiej wprowadzać ulepszenia do gospodarstw wielkoobszarowych, w których efekty takich działań będą odpowiednio zauważalne. Nie wszystkie rozwiązania technologiczne rolnictwa precyzyjnego wprowadzać należy jednocześnie. Dla zmniejszenia kosztów można to robić stopniowo, co stanowi najlepsze rozwiązanie dla rolników – właścicieli mniejszych gospodarstw [Grzebisz 2012]. Koncepcja rolnictwa precyzyjnego oparta jest na wiedzy wspomaganej poprzez najnowsze technologie informatyczne i telekomunikacyjne z wykorzystaniem dostosowanych do tego maszyn i urządzeń [Koronczok 2013; Samborski 2018]. Zakres działań rolnictwa precyzyjnego obejmuje:

- procesy i zabiegi dotyczące zmienności gleby,
- automatyzację prac polowych,
- sprawne zarządzanie całością gospodarstwa [Doruchowski 2005].

Pozwala to na efektywne wykorzystanie, bez uszczerbku dla środowiska naturalnego, wykorzystania środków produkcji i podniesienie wielkości i jakości plonowania [Hołownicki 2008]. Zbieranie, przetwarzanie i analiza informacji odbywa się za pomocą tzw. Systemu Informacji Przestrzennej, który obejmuje odpowiednie narzędzia, metody i niezbędne oprogramowanie. Mapy służą do tworzenia dokumentacji i baz danych. Są stosowane w zarządzaniu produkcją i w pracy maszyn w czasie zabiegów polowych [Jaczewska – Kalicka 2008; Lipiński 2005]. Uzyskane tak informacje ułatwiają podjęcie właściwych decyzji dotyczących: odpowiedniego nawożenia, ustalania dawek nawozów, zabiegów ochrony roślin, zmiennej aplikacji zabiegów ochrony roślin [Dominik 2010].

W rolnictwie precyzyjnym do badania właściwości gleby stosuje się czujniki i systemy rejestrujące podczas jazdy. Najczęściej stosowane są urządzenia oparte na przewodności elektrycznej lub na oporze elektrycznym [Gozdowski i in. 2007] Wykorzystywane są urządzenia sterujące nawożeniem mineralnym i środkami ochrony roślin, które zarządzają rozsiewaczem lub opryskiwaczem z kabiny ciągnika. Skutkuje to aplikowaniem nawozu lub środka ochronnego od razu po identyfikacji zmienności miejscowej [Doruchowski 2008]. W ramach rolnictwa precyzyjnego zwalczane jest zachwaszczenie, do czego służy teledetekcja przy użyciu urządzeń satelitarnych, lotniczych i naziemnych [Nieróbca 2009]. Rolnictwo precyzyjne daje możliwość aplikowania zmiennych dawek nawozów mineralnych dopasowanych do warunków glebowych danej strefy pola i wymagań pokarmowych roślin. Technologie zmiennego dawkowania (Variable

Rate Aplication - VRA) przynoszą znaczące korzyści w postaci ograniczenia zużycia nawozów mineralnych. Nieodłącznym elementem VRA są mapy aplikacyjne z przydzielonymi dawkami tworzone przy pomocy specjalistycznego oprogramowania umożliwiającego kalkulację całego zapotrzebowania na nawozy.

Wadą rolnictwa precyzyjnego są ceny stosowanych urządzeń, bowiem koszt zakupu sprzętu, który nawiguje maszynę rolniczą jest wydatkiem oscylującym na poziomie około kilku, nawet kilkudziesięciu tysięcy złotych. Taka rozpiętość cen wynika z faktu, że narzędzia i maszyny stosowane w rolnictwie precyzyjnym muszą być zdecydowanie dokładniejsze. Im więcej rolnik zapłaci za urządzenie, tym lepsze efekty osiągnie [Nieróbca 2009].

Zaletą rolnictwa precyzyjnego jest fakt, że jest ono odpowiedzią na potrzebę realizacji zrównoważonego rozwoju, przyjazne dla środowiska i opłacalne ekonomicznie. Rolnictwo nowoczesne stanowi cel, do którego osiągnięcia polscy rolnicy muszą dążyć, jeśli nie chcą być daleko w tyle za swoimi zagranicznymi konkurentami. Ważną zaletą rolnictwa precyzyjnego jest zawsze odpowiednio dobrana dawka ilości środków, co pociąga za sobą fakt, że zaoszczędzone tak pieniądze można przeznaczyć na kolejne inwestycje. Dzięki programom komputerowym można dokonać symulacji efektu finansowego, jaki może przynieść nadchodzący sezon. Ułatwi to planowanie budżetu w gospodarstwie [Nieróbca 2009]. Zaletą i bardzo mocną stroną rolnictwa precyzyjnego jest system pozycjonowania maszyn na polach i drogach za pomocą sygnału satelitarnego dający możliwość różnorodnego zastosowania w codziennych pracach w gospodarstwie [Samborski i in. 2012].

Cel, przedmiot i metodyka badań

Celem badań był analiza zastosowania wybranych technik rolnictwa precyzyjnego w gospodarstwie rolnym. Badania zostały przeprowadzone w gospodarstwie rolnym zajmującym się produkcją roślinną w okresie od kwietnia do września 2019 roku. Dodatkowo prowadzono obserwacje wielu gospodarstw w okolicy, które zajmują się produkcją roślinną, rozmawiano z ich właścicielami, analizowano techniki rolnictwa precyzyjnego.

Badania przeprowadzono w gospodarstwie rolnym, zajmującym się produkcją roślinną we wsi położonej w gminie Drohiczyn. Zakres badań obejmował wywiad z właścicielami, analizę udostępnionych materiałów i dokumentowanie fotograficzne. Zbierano informacje dotyczące wdrażania nowoczesnych technologii w gospodarstwie, pytano o modernizację jaką wprowadzono w gospodarstwie. Ponadto zebrano informacje dotyczące parku maszynowego i

udogodnień technologicznych, jakie właściciele wprowadzili w ostatnich latach w szczególności dotyczące zastosowania nowoczesnych technologii, wszelkich zmian, jakie się z nim wiążą.

Wyniki badań

Badane gospodarstwo prowadzi produkcję roślinną na glebach klasy IIIa, IIIb i IV. Jego powierzchnia to 160 ha gruntów własnych, w tym:

- rzepak ozimy – 40 ha,
- pszenica ozima – 60 ha,
- kukurydza – 50 ha,
- zazielenienie: łubin i inne rośliny strączkowe – 10 ha.

W gospodarstwie rolnym zboże przechowywane jest w silosach lub bezpośrednio sprzedawane podczas żniw. Maszyny uprawowe i ciągniki przechowywane są w zmodernizowanej stodole z 1980r., natomiast przyczepy wykorzystywane w gospodarstwie, przenośniki ślimakowe, osprzęt do ładowacza czołowego gospodarz przechowuje pod wiatą.

Tabela. 1. Park maszynowy z rokiem produkcji
Źródło: opracowanie własne na podstawie przeprowadzonych badań

Table. 1. Machine park with year of production
Source: own survey on the basis of conducted research

	Rok produkcji Production year
Ciągnik Tractor John Deere 7250R	2015
Ciągnik Tractor John Deere 6150R	2010
Ciągnik Tractor John Deere 6170R	2010
Pług Plow Lemken EurOpal 7	2015
Agregat uprawowy Cultivating aggregate Lemken Solitar 9	2015
Przyczepy rolnicze Agricultural trailers Fliegl (2 szt.)	2009
Przyczepa rolnicza Agricultural trailer Wielton	2017
Opryskiwacz polowy Field sprayer Amazone UF 1801	2016
Opryskiwacz polowy Field sprayer Amazone FT 1001	2015
Siewnik do kukurydzy Maize seedre Amazone ED 6000-2C Special	2014
Rozsiewacz do nawozów Fertilizer spreader Amazone ZA-TS	2013
Brona talerzowa Disc harrow Lemken Rubin 9	2015
Rozsiewacz do wapna Lime spreader Amazone	2010

Na wyposażeniu gospodarstwa jest nowoczesny park maszynowy, za pomocą którego

można używać różnych aplikacji a także doposażać w dodatkowe rozwiązania. Ciągnik John Deere 7250R wyposażony jest w silnik o mocy 229 kW (320KM) i inne rozwiązania, pozwalające na wysoką wydajność i sprawność przy niskich kosztach eksploatacji i małym zużyciu paliwa. Ciągnik jest wyposażony w komputer do nawigacji satelitarnej, pozwalający na precyzyjne nawożenie i opryski bez nakładek. Agripilot działa na każdym tablecie i smartfonie. Gospodarz posiada dedykowany wyświetlacz Agripilot 700S z możliwością rozbudowy. W przypadku rolnictwa precyzyjnego pomiar RTK zapewnia największą dokładność, powtarzalność i najkrótszy czas uzyskiwania danych oraz eliminuje przesunięcia występujące w systemie GIS. Dzięki wykupionej licencji sygnału RTK odbieranego przez wbudowany systemy JDLink (Starfire 6000) uzyskuje się dokładność pomiaru nawet do 2 cm. Agripilot ma wbudowany moduł kompensacji terenu IMU niezbędny do prac polowych, w których precyzja ma największe znaczenie. Doskonale sprawdza się w połączeniu z systemem automatycznego kierowania. Agripilot został rozbudowany o:

- moduł automatycznej kontroli sekcji,
- moduł automatycznego kierowania.

Agripilot oferuje różne typy prowadzenia równoległego:

- linia prosta,
- linia krzywa,
- kopiowanie ostatniego przejazdu.

Koszt Agripilota wraz z anteną oscylował na poziomie 2600 zł.

Ciągniki John Deere 6170R i John Deere 6150R wyposażone są w wydajny silnik PowerTech PVX o mocy 158kW (215KM), posiada również wygodną w obsłudze przekładnię biegów. Ciągniki są wyposażone w DPF (filtr cząstek stałych) i w katalizator DOC, dzięki czemu spełniają normy ekologiczne klasy IIIB.

Pług Lemken EurOpal 7 posiada 5 korpusów i charakteryzuje się wysoką wytrzymałością i małą wagą. Łatwość jego uciągu oznacza wysoką skuteczność. Centrum regulacji OPITIQUICK pozwala na niezależną regulację szerokości przedniej skiby i punktu ciągnięcia przy wyeliminowaniu działania sił bocznych. Korpusy nastawne montowane są śrubami do grubego elementu o kwadratowym profilu wykonanym ze stali, co zapewnia wysoką stabilność, wytrzymałość i dokładność montażu. Belka zaczepowa posiada regulowaną wysokość, dlatego ma zastosowanie w każdych warunkach roboczych i zapewnia właściwe położenie dolnych cięgien ciągnika.

Na wyposażeniu gospodarstwa jest także siewnik pneumatyczny z broną aktywną Lemken Solitair 9. Rolnik posiada także wyspecjalizowane przyczepy rolnicze trzyosiowe o dużej

ładowności i pojemności skrzyni ładunkowej (26m^3). Ładowność 16 ton. Gwarantują one ekonomiczny transport i ograniczenie kosztów produkcji.

Opryskiwacze polowe Amazone UF 1801 i Amazone FT 1001 odpowiadają wymaganiom przepisów o ochronie roślin i najwyższym normom europejskim – certyfikacja ENTAM, D – 1732. Opryskiwacze są certyfikowane zgodnie z testem zgodności AEF UT 2.0. i mogą być obsługiwane przez wszystkie znajdujące się na rynku terminale certyfikowane zgodnie z UT 2.0.

Siewnik do kukurydzy Amazone ED 6000-2C Specjal na wyposażeniu gospodarstwa jest precyzyjny i niezawodny. Atutem jest precyzyjny rozdział dzięki niewielkiej ilości spadania 10 i 14 cm oraz liczne tarcze rozdzielające, zapewniające optymalne ustawienie. Siewnik posiada redlinę w kształcie klina, co zapobiega toczeniu się nasion. Efektem jest niezawodne przykrycie nasion na wszystkich glebach dzięki dodatkowym narzędziom zgarniającym. Zaletą maszyny jest siew punktowy w połączeniu z rozsiewaniem nawozu. Brona talerzowa Lemken używana jest w gospodarstwie do płytkiej uprawy ścierniska i siew na glebach lekkich i średnich. Maszyna odznacza się wysoką wydajnością roboczą dzięki niskiemu zapotrzebowaniu na moc i wysokiej prędkości roboczej.

Rozsiewacze nawozów mogą automatycznie zmieniać szerokość roboczą, co daje duże oszczędności. W rozsiewaczu zastosowanie znalazł GPS-Switch, czyli automatyczny system firmy Amazone, który pozwala w czasie pracy opryskiwacza, siewnika lub rozsiewacza ograniczyć do minimum nakładki i zużycie cieczy roboczej, nasion, nawozów czy środków ochrony roślin.

Korzyści, jakie wynikają z zastosowania systemu, rolnik dostrzega na prostokątnym polu z idealnie rozlokowanymi ścieżkami technologicznymi. Jako przykład właściciel gospodarstwa podaje, że rozsiewacz automatycznie zakończy pracę w optymalnym punkcie przy wjeżdżaniu na uwrocie, precyzyjnie włączy tarcze i otworzy zasuwę, gdy rolnik z niego wyjeżdża, znajdując się już w kolejnej ścieżce przejazdowej. Na dokładnym rozpoczynaniu i kończeniu pracy przy uwrociach rolnik zyskuje sporo na eliminacji nakładek, te, podczas pracy „na oko" zdarzają się zawsze. A to z kolei przełożyć się może na przenawożenie tych miejsc, co niejednokrotnie skutkuje obniżeniem plonów. GPS-Switch pozwala dopasować punkt włączania i wyłączania rozsiewu pod konkretny nawóz.

Zainspirowany technologią rolnik zdecydował się na zakup systemu prowadzenia John Deere Premium. Nowy zestaw ATU 300 zachwycił go zdecydowanie szybszym naprowadzaniem na linie, niższym poziomem hałasu i bardziej zintegrowaną konstrukcją. Zakupiony Pakiet ATU 300 zawiera następujące elementy:

- system prowadzenia dla mieszanych flot rolniczych,

- odbiornik Starfire 6000,
- wyświetlacz uniwersalny 4240.

System prowadzenia dla mieszanych flot rolniczych instalować może w każdym ciągniku, gdyż jest on łatwy w instalacji i obsłudze oraz bardzo solidny i niezawodny. Prędkość minimalna wynosi tylko 0,5 km/h, a z maszyny do maszyny można go przenieść w niecałe pół godziny. Odbiornik Starfire 6000 szybko lokalizuje tor jazdy i śledzi sygnał korekcyjny z minimum 3 satelitów równocześnie, dzięki czemu oferuje najlepszy sygnał. Odbiornik zawsze aktywnie wybiera najlepszy sygnał, a w razie potrzeby (zmiany warunków) przełącza się o 80% szybciej na satelitę geostacjonarnego z najlepszym sygnałem.

Rycina 1. System prowadzenia John Deere
Źródło: opracowanie własne

Fig. 1. ***Oxytree trees in the second growing season. Photo from 01/09/2020***
Source: own survey on the basis of conducted research

Wyświetlacz uniwersalny 4240 jest odporny na wodę i pył, posiada funkcję dokumentacji i zmiennego dawkowania. Jest przygotowany do obsługi zdalnego dostępu do wyświetlacza i bezprzewodowej transmisji danych. Wyświetlacz (8,4") posiada pełną certyfikację ISOBUS AEF. Koszt zakupu systemu, w tym anteny, okablowania i systemu pozycjonowania (z m. in. automatycznym prowadzeniem i jazdą równoległą) z rabatem przy zakupie nowego ciągnika oscylował na poziomie 42.000 zł.

Właściciel gospodarstwa wskazał wiele korzyści płynących z zakupu, w tym:

- oszczędność na środkach ochrony roślinna poziomie ok. 4% (przy wyłączeniu odpowiednich sekcji podczas oprysku nie nanosi się cieczy roboczej ba łan dwukrotnie),
- oszczędność na nawozach na poziomie ok. 6% (przy klinach i uwrociach nie wysiewa się nawozu, gdyż w tym miejscu rośliny nie wylegają),
- oszczędność na materiale siewnym na poziomie ok. 4%,
- oszczędność paliwa na poziomie ok. 5% (ograniczona została liczba przejazdów).

Dodatkowo gospodarz nadmienił, że podczas zbiorów kombajn pracuje z większą prędkością, gdyż łan jest równy. Praca rolnika, podczas włączonego pilota, nie wymaga wzmożonego skupienia; praca jest ułatwiona i odciążona oraz ulega skróceniu, oszczędność czasu.

Wiosną 2021 roku właściciel badanego gospodarstwa chce wdrożyć w moduł CLASS Crop View, ponieważ szkolenia dla rolników, w których brał udział, uświadomiły go, że przy pomocy takiego modułu może szybko i łatwo określić różnice wegetacyjne na polach i na ich podstawie tworzyć mapy aplikacji. Na zakup modułu CLASS Crop View właściciel gospodarstwa sporządził biznesplan. Cel inwestycji: możliwość szybkiego i łatwego określenia różnic wegetacyjnych na polach, a na ich podstawie tworzenie mapy aplikacji. W wyniku udoskonalenia gospodarstwa poprzez zainwestowanie w moduł zapewnione zostanie bardzo szybkie przetwarzanie danych satelitarnych. Aplikacja przetworzy satelitarne dane źródłowe celem uzyskania informacji o stanie uprawianych roślin. Moduł będzie dla niego wsparciem w podejmowaniu decyzji dotyczących zastosowań środków na poszczególnych częściach swoich pól. Dzięki integracji z systemem 365 FarmNet będzie mógł przeglądać zdjęcia satelitarne swoich pól. Właściwe wyposażone zaplecze techniczno – technologiczne, dostosowane do potrzeb gospodarstwa, jest podstawą prawidłowego i efektywnego gospodarowania. Gospodarstwo wciąż się rozwija i dobrze prosperuje, co wynika z wielkości otrzymywanych przychodów i ponoszonych wydatków (Tab.2, Tab.3).

Tabela. 2. Wydatki finansowe w gospodarstwie (w PLN)
Źródło: opracowanie własne na podstawie przeprowadzonych badań

Table. 2. Financial expenses on the farm (in PLN)
Source: own survey on the basis of conducted research

Ubezpieczenie maszyn oraz upraw Machinery and crop insurance	65.000
Paliwo Fuel	130.000
Nawozy oraz środki ochrony roślin Fertilizers and plant protection products	250.000
Serwis maszyn Machine service	50.000
Części zamienne do maszyn Spare parts for machines	9.500

Materiał siewny Seed material	120.000
Pozostałe wydatki w gospodarstwie Other expenses on the farm	80.000
Razem Total	704.500

Tabela. 3. Przychody gospodarstwa (w PLN)
Źródło: opracowanie własne na podstawie przeprowadzonych badań

Table. 3. Farm income (in PLN)
Source: own survey on the basis of conducted research

Dopłaty I usługi Surcharges and services	200.000
Sprzedaż zbóż Cereals sale	850.000
Razem Total	1.050.000

Z danych zaprezentowanych w tabelach 2 i 3 wynika, że roczny dochód gospodarstwa oscyluje na poziomie 345.500 zł. Dochód ten pomniejszony jest jeszcze o koszty zatrudnienia pracowników do pomocy w gospodarstwie w najbardziej pracowitym okresie. Niemniej jednak gospodarstwo rozwija się bardzo dobrze i ma przed sobą wielkie perspektywy. Analizując koszty usług rolniczych i terminów oczekiwania na usługodawcę w zakresie koszenia zbóż w badanym regionie możemy rozważyć zakup nowego kombajnu zbożowego. Kombajn może zostać wykorzystany na zbiór areału gospodarstwa i usługi świadczone dla okolicznych rolników.

Rysunek 2. Kombajn zbożowy John Deere T660
Źródło: https://www.deere.pl/pl/kombajny/seria-t/t660/, data dostępu: 12.09.2019

Figure. 2. ***Harvester combine John Deere T660***
Source: https://www.deere.pl/pl/kombajny/seria-t/t660/, date of access: 12.09.2019

Kombajn zbożowy John Deere T660 byłby optymalnym wyborem dla rolnika, ponieważ:

- jest to sprawdzona marka, wykorzystywana już w gospodarstwie,
- uzyskuje dobrą wydajność dzięki wyposażeniu oferowanemu przez dany model np. (duża powierzchnia sit w m^2, 6 wytrząsaczy i unikalny układ młócący pozwalający na większą przepustowość kombajnu, system HM pozwalający na poziomowanie hederu i ułatwienie zbioru na polach o spadku terenu do 22%),
- posiada duży zbiornik na ziarno oraz szybką przepustowość podczas wyładunku,
- wyposażony jest w system AutoTrac pozwalający na automatyczne prowadzenie kombajnu, co zapobiega nakładaniu się przejazdów oraz zwiększa wydajność,
- umożliwia automatyczną optymalizację ustawień maszyny,
- wyposażony jest w system mapowania pól, określając plon i pozwalając na analizę plonu z konkretnych części pola,
- dobre doświadczenie z serwisem oferującym zdalną pomoc.

Tabela. 4. Wydatki poniesione na zakup kombajnu zbożowego oraz jego eksploatację (w PLN)
Źródło: opracowanie własne na podstawie przeprowadzonych badań

Table. 4. Expenses incurred for the purchase of a combine harvester and its operation (in PLN)
Source: own survey on the basis of conducted research

	Koszt zakupu Cost of purchase	**Wydatki w sezonie High season expenses**
Kombajn zbożowy z hederem oraz przystawką do kukurydzy Combine harvester with header and corn attachment	1.180.000	
Smar, olej, filtry Grease, oil, filters		5.500
Inne wydatki Other expenses		10.500
Razem Total		16.000

Tabela. 5. Jednostkowy koszt usług (w PLN)
Źródło: opracowanie własne na podstawie przeprowadzonych badań

Table. 5. Unit cost of services (in PLN)
Source: own survey on the basis of conducted research

Paliwo Fuel (20 $l \cdot ha^{-1}$), Cena Price ON 4,50zł	90
Koszt usługi za ha Cost of the service per ha	330
Cena za godzinę pracy operatora Operator work per hour	25

Wydajność kombajnu przy zbiorze zbóż, w tym kukurydzy, wynosi między od 2,5 do 3,5 $ha \cdot h^{-1}$. Do obliczeń przyjęto wydajność kombajnu na poziomie 3$ha \cdot h^{-1}$, praca operatora kombajnu została wyceniona na kwotę 25 $zł \cdot h^{-1}$.

Tabela. 6. Jednostkowy koszt usług (w PLN)
Źródło: opracowanie własne na podstawie przeprowadzonych badań

Table. 6. Unit cost of services (in PLN)
Source: own survey on the basis of conducted research

	Gospodarstwo Farm	**Usługi Services**
Planowane przychody Planned income		
Zakładana powierzchnia ha do skoszenia rocznie Estimated area of ha to be mowed annually	150	650
Przychody Income (PLN)	**49.500**	**214.500**
Razem przychody roczne Total income revenues (PLN)		**264.000**
Planowane wydatki Planned expenses		
Cena paliwa Fuel price (PLN)	13.500	58.500
Operator Operator (PLN)	1.250	5.420
Serwis Service	16.000	
Wydatki Expenses (PLN)	**30.750**	**63.920**
Razem wydatki roczne Total annual expenses (PLN)		**94.670**
Zysk Profit (PLN)		**169.330**

Z analizowanych danych możemy zauważyć, że zakładany zysk podczas pracy kombajnu po odliczeniu paliwa oraz serwisu zapewni gospodarzowi zwrot nakładów poniesionych na zakup kombajnu po 7 latach jego eksploatacji.

Czas zwrotu inwestycji:

1.180.000zł/ 169.330zł = okres 7 lat

Okres ten może ulec wydłużeniu na skutek wystąpienia usterek, przestojów itp. Zmianie mogą ulec koszty wskutek nieprzewidzianych napraw czy zmian założonych cen.

Tabela. 7. Analiza SWOT dla opłacalności zakupu kombajnu
Źródło: opracowanie własne na podstawie przeprowadzonych badań

Table. 7. SWOT analysis for the profitability of purchasing a combine
Source: own survey on the basis of conducted research

Mocne strony Strengths	**Słabe strony Weaknesses**
- współpraca z usługodawcą, - zbiór w optymalnym terminie, - oszczędność czasu, - nowy sprzęt mniej awaryjny, - dzięki wykorzystaniu nowoczesnych technologii odciążona będzie praca operatora.	- wykonanie usługi może w znacznym stopniu zależeć od warunków atmosferycznych, - rozdrobnienie pól i zwiększenie kosztów dojazdów do działki, - stosunkowo wysoki koszt zakupu, - niestabilność cen,
Szanse Chances	**Zagrożenia Threats**
- lepsza jakość plonów, - szybszy zbiór, - rozwój usług dla rolników, - wykorzystanie zaawansowanych technologii, - wzrost wydajności, - oszczędność czasu,	- możliwy brak zleceń, - niestabilne ceny paliw i innych składowych niezbędnych do prawidłowego funkcjonowania maszyny, - wady techniczne sprzętu, - ryzyko inwestycyjne.

- obniżenie kosztów jednostkowych produkcji.	

Podsumowanie

Nowoczesne rozwiązania stosowane w agrotechnice mogą być stosowane w gospodarstwach rolnych o różnej powierzchni gruntów własnych i dzierżawionych. Każdy rolnik chce jak najlepiej wykorzystać swoje zasoby. Badania wykazały, że właściciel gospodarstwa posiada maszyny wyposażone w technologie umożliwiające stosowanie systemu rolnictwa precyzyjnego. Dzięki maszynom wyposażonym w nowoczesne urządzenia pomiarowe rolnik otrzymuje szczegółowe informacje dotyczące wysokości plonu w określonym sektorze pola. Maszyna wyposażona w system pozycjonowania satelitarnego przesyła dane do komputera, co w efekcie daje gotową mapę. Mapa zawiera wszystkie potrzebne informacje i dane, a wydruk z komputera stanowi instrukcję, zgodnie z którą rolnik ma postępować: widzi też miejsca, które wymagają więcej troski i uwagi.

Szeroko pojmowane rolnictwo precyzyjne jest systemem gospodarowania, który znacznie opiera się na gromadzeniu i przetwarzaniu danych o charakterze przestrzennym. Początkowo technologie satelitarne wspierały operatora w prowadzeniu maszyny w linii prostej, ale kolejne ich generacje dają już możliwość jazdy ciągników i maszyn samobieżnych nie tylko po liniach prostych, ale również po liniach łamanych. Odzwierciedlają one kształt pola z dokładnością do 2 cm. Najbardziej zaawansowane technologie pozwalają na wykonanie nawrotu maszyny na uwrociu pola w trybie automatycznym i powrót na wyznaczoną trajektorię.

Rolnictwo precyzyjne jest przyszłością, a uprawa z pomocą technologii pociąga za sobą mniejsze zużycie zasobów i lepszą wydajność. Inwestycja w takie rozwiązania jest wielką korzyścią i zmniejszeniem negatywnego oddziaływania na środowisko [Samborski i in. 2012]. Koncepcja rolnictwa precyzyjnego oparta jest na wiedzy wspomaganej poprzez najnowsze technologie informatyczne i telekomunikacyjne z wykorzystaniem dostosowanych do tego maszyn i urządzeń [Samborski i in. 2012]. Ciągle rozwijane są technologie mające ba celu doskonalenie technologii monitorujących kondycję upraw i właściwości gleby. Aktualnie parametrami agregatu maszynowego i monitorowaniem jego stanu zajmuje się operator, który znajduje się w kabinie, bądź robi to zarządca parku maszynowego, który może przebywać także poza gospodarstwem. W przyszłości będzie to technologia satelitarna i technologia IoT, czyli autonomiczne ciągniki i maszyny, które pracują bez operatora. Takie rozwiązania są jeszcze na etapie prototypów, które czołowi producenci maszyn i ciągników rolniczych testują na polach. Jak wykazały badania system prowadzenia John Deere Premium dla właściciela gospodarstwa to zwiększenie wydajności maszyn, poprawa jakości upraw i plonów, przy jednoczesnym

zmniejszeniu eksploatacji i zwiększeniu komfortu jego pracy. Zakup kombajnu John Deere T660 to inwestycja, która pozwoli na zbiór w gospodarstwie w optymalnym terminie oraz zamortyzuje się w ciągu 7 lat. Dla właściciela badanego gospodarstwa wdrożenie rolnictwa precyzyjnego to:

- oszczędność na środkach ochrony roślin 4%
- na nawozach mineralnych 6%
- na materiale siewnym 4%
- na paliwie 5%.

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Regulamin nadsyłania i publikowania prac w Zeszytach Naukowych WSA

1. Zeszyty Naukowe Wyższej Szkoły Agrobiznesu, zwane dalej Zeszytami, są periodykiem naukowym wydawanym w nieregularnym cyklu wydawniczym.
2. Treść każdego Zeszytu odpowiada zakresowi tematycznemu jednego z odpowiednich wydziałów w Wyższej Szkole Agrobiznesu t. Wydziałowi Rolniczo-Ekonomicznemu, Wydziałowi Technicznemu, bądź Wydziałowi Medycznemu.
3. Redakcja Zeszytów mieści się w sekretariacie Wydawnictwa Wyższej Szkoły Agrobiznesu. Pracą redakcji kieruje redaktor naczelny.
4. W celu zapewnienia poziomu naukowego Zeszytów oraz zachowania właściwego cyklu wydawniczego redakcja współpracuje z krajowymi i zagranicznymi jednostkami naukowymi, stowarzyszeniami oraz innymi instytucjami.
5. Do oceny przyjmowane są dotychczas niepublikowane oryginalne prace redakcyjne, monograficzne, poglądowe, historyczne, teksty źródłowe, sprawozdania z posiedzeń naukowych, oceny książek, komunikaty naukowe, wspomnienia oraz wiadomości jubileuszowe. Opracowania przyjmowane są przez redakcję do końca czerwca każdego roku. Redakcja nie zwraca Autorom nadesłanych materiałów.
6. Do publikacji należy dołączyć oświadczenie o oryginalności pracy oraz o tym, że nie została zgłoszona do innej redakcji (wzór oświadczenia jest możliwy do pobrania na stronie internetowej WSA – załącznik nr 1 do Regulaminu). Oświadczenie powinno zawierać adres pierwszego autora pracy, numer telefonu oraz e-mail. W oświadczeniu powinna być zawarta zgoda (podpis) wszystkich współautorów pracy.
7. Prace są publikowane w języku polskim lub angielskim z uwzględnieniem opinii redaktora językowego.
8. W oświadczeniu dołączonym do tekstu należy opisać wkład poszczególnych autorów w powstanie pracy oraz podać źródło finansowania publikacji. *„Ghostwriting”* oraz „*guest authorship*” są przejawem nierzetelności naukowej, a wszelkie wykryte przypadki będą demaskowane i dokumentowane, włącznie z powiadomieniem odpowiednich podmiotów (instytucje zatrudniające autorów, towarzystwa naukowe, stowarzyszenia edytorów naukowych itp.).
9. Przekazane do redakcji opracowania są wstępnie oceniane i kwalifikowane do druku przez Naukową Radę Redakcyjną, zwaną dalej Radą. Skład Rady określany jest przez Senat WSA.
10. Publikacje wstępnie zakwalifikowane przez Radę są oceniane przez recenzentów, zgodnie z procedurą recenzowania opublikowaną na stronie internetowej WSA w zakładce Zeszyty naukowe WSA. Łącznie z opinią recenzent wypełnia deklarację konfliktu interesów, stanowiącą załącznik nr 2 do regulaminu. Redakcja powiadamia Autorów o wyniku oceny, zastrzegając sobie prawo do zachowania poufności recenzji.
11. Za proces wydawniczy Zeszytów jest odpowiedzialny sekretarz naukowy redakcji, który zatwierdza układ treści Zeszytów, określa wymagania wydawnicze dla publikowanych materiałów, współpracuje z recenzentami, przedstawia do zatwierdzenia całość materiałów przed drukiem Naukowej Radzie Redakcyjnej, współpracuje z Radą i innymi instytucjami w zakresie niezbędnym do zapewnienia poziomu naukowego Zeszytów oraz zachowania cyklu wydawniczego.
12. Redakcja zastrzega sobie możliwość odmowy przyjęcia artykułu bez podania przyczyn.
13. Nadesłane materiały, niespełniające wymagań wydawniczych określonych przez redakcję, są zwracane Autorowi/Autorom.
14. Wydawnictwo Wyższej Szkoły Agrobiznesu nie wypłaca wynagrodzenia za nadesłane publikacje zakwalifikowane do druku w Zeszytach.
15. Wersją pierwotną (referencyjną) czasopisma jest wydanie papierowe. „Zeszyty Naukowe WSA" są dostępne także na stronie internetowej Wyższej Szkoły Agrobiznesu – www.wsa.edu.pl, w zakładce Wydawnictwa.

Wymagania wydawnicze - Zeszyty Naukowe WSA

1. Artykuły powinny być przygotowane w formie wydruku komputerowego oraz w wersji elektronicznej, w języku polskim lub angielskim. W celu usprawnienia procesu wydawniczego prosimy o rygorystyczne przestrzeganie poniższych zasad:
   - przesłany artykuł powinien być opatrzony dokładną afiliacją Autora/Autorów,
   - objętość artykułu nie może przekraczać 15 stron formatu A4,
   - imię i nazwisko Autora/ów – czcionka 12 pkt,
   - nazwa instytucji/jednostki naukowej – czcionka 12 pkt,
   - tytuł artykułu w języku polskim i angielskim – czcionka 14 pkt (bold); podtytuły – czcionka 12 pkt (bold),
   - do publikacji należy dołączyć słowa kluczowe (3–5) oraz streszczenie nieprzekraczające 15 wierszy napisane w językach polskim i angielskim – czcionka 11 pkt,
   - tekst zasadniczy referatu pisany czcionką Times New Roman CE – 12 pkt,
   - odstęp między wierszami – 1,5,
   - jeżeli referat zawiera tabele (najlepiej wykonane w edytorze Word albo Excel) lub rysunki (preferowany format CorelDraw, Excel, Word), należy dołączyć pliki źródłowe,
   - tabele i rysunki powinny być zaopatrzone w kolejne numery, tytuły i źródło,
   - przy pisaniu wzorów należy korzystać wyłącznie z edytora równań dla MS WORD,
   - preferowane formaty zdjęć: TIFF, JPG (o rozdzielczości minimum 300 dpi),
   - w przypadku publikowania prac badawczych układ treści artykułu powinien odpowiadać schematowi: wprowadzenie (ewentualnie cel opracowania), opis wykorzystanych materiałów czy metod, opis badań własnych (omówienie wyników badań), wnioski (podsumowanie), wykaz piśmiennictwa.

2. Odsyłaczami do literatury zamieszczonymi w tekście publikacji są przypisy dolne, które muszą mieć numerację ciągłą w obrębie całego artykułu. Odsyłaczami przypisów dolnych są cyfry arabskie złożone w indeksie górnym, np. (2).

3. Zapis cytowanej pozycji bibliograficznej powinien zawierać: inicjał imienia i nazwisko autora, tytuł dzieła, miejsce i rok wydania, numer strony, której dotyczy przypis; w przypadku pracy zbiorowej: tytuł dzieła, inicjał imienia i nazwisko redaktora, miejsce i rok wydania; w przypadku pracy będącej częścią większej całości – także jej tytuł, inicjał imienia i nazwisko redaktora. Źródła internetowe oraz akty prawne należy podawać także jako przypis dolny.

4. W wykazie piśmiennictwa zamieszczonym w kolejności alfabetycznej na końcu publikacji należy podać kolejno: nazwisko autora/ów i pierwszą literę imienia, rok wydania, tytuł pracy (czcionka italic), wydawnictwo oraz miejsce wydania. Przykłady:
   - **wydawnictwa książkowe: Janowiec A. 2010.** *Ziemniaki skrobiowe – rola w województwie podlaskim*. Wydawnictwo WSA, Łomża.
   - **prace zbiorowe:** Górczewski R. (red.) 2007. *Przemieszczenie trawieńca*. Wydawnictwo PWN, Warszawa.
   - **czasopisma:** Staszewski M., Getek I. 2007. *Specyfika żywienia krów o wysokiej wydajności*. Wydawnictwo WSA, Łomża, Zeszyty Naukowe WSA nr 37.
   - **strony internetowe:** www.4lomza.pl. 1.12.2009 r.
   - **akty prawne:** Ustawa z dnia 27 lipca 2002 r. o zmianie ustawy o szkolnictwie wyższym oraz ustawy o wyższych szkołach zawodowych. Dz.U. z 2002 r. Nr 150, poz. 1239.

UWAGA: teksty niespełniające powyższych wymagań zostaną zwrócone Autorowi

Procedura recenzowania prac naukowych nadsyłanych do publikacji w Zeszytach Naukowych Wyższej Szkoły Agrobiznesu

Procedura recenzowania artykułów w Zeszytach Naukowych WSA jest zgodna z zaleceniami Ministerstwa Nauki i Szkolnictwa Wyższego oraz dobrymi praktykami w procedurach recenzyjnych w nauce *.

Przekazanie publikacji do Redakcji Wydawnictwa WSA jest jednoznaczne z wyrażeniem przez Autora/Autorów zgody na wszczęcie procedury recenzji artykułu. Autor/Autorzy przesyłają utwór wraz z wypełnionym oświadczeniem, którego wzór znajduje się na stronie internetowej WSA. Nadesłane materiały są poddawane wstępnej ocenie formalnej przez Naukową Radę Redakcyjną WSA, zwaną dalej Radą, zwłaszcza pod kątem ich zgodności z wymaganiami wydawniczymi opracowanymi i publikowanymi przez Wyższą Szkołę Agrobiznesu, jak również obszarami tematycznymi ZN. Następnie artykuły są recenzowane przez dwóch niezależnych recenzentów, którzy nie są członkami Rady, posiadających co najmniej stopień naukowy doktora. Nadesłane artykuły nie są nigdy wysyłane do recenzentów z tej samej placówki, w której zatrudniony jest Autor/Autorzy. Prace recenzowane są anonimowo. Autorzy nie znają nazwisk recenzentów. Artykułowi nadawany jest numer redakcyjny, identyfikujący go na dalszych etapach procesu wydawniczego. W innych przypadkach recenzent podpisuje deklarację o niewystępowaniu konfliktu interesów – formularz jest publikowany na stronie Internetowej WSA. Autor każdorazowo jest informowany z zachowaniem zasady poufności recenzji o wyniku procedury recenzenckiej, zakończonej kategorycznym wnioskiem o dopuszczeniu bądź odrzuceniu publikacji do druku. W sytuacjach spornych powoływany jest kolejny recenzent.

Lista recenzentów współpracujących z wydawnictwem publikowana jest w każdym numerze czasopisma oraz na stronie Internetowej WSA.

* Dobre Praktyki w procedurach recenzyjnych w nauce. Zespół do Spraw Etyki w Nauce. Ministerstwo Nauki i Szkolnictwa Wyższego. Warszawa 2011

Załącznik nr 1

miejscowość, data.....,.....

Oświadczenie Autora/Autorów

Zwracam się z uprzejmą prośbą o przyjęcie do Redakcji Wydawnictwa WSA i ogłoszenie drukiem publikacji/pracy pt.

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autorstwa:

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Równocześnie oświadczam(y), że publikacja nie została wydana w przeszłości drukiem i/lub w wersji elektronicznej w innym czasopiśmie, nie została zgłoszona do innego czasopisma, nie znajduje się w recenzji innej Redakcji, nie narusza patentów, praw autorskich i praw pokrewnych oraz innych zastrzeżonych praw osób trzecich, a także że wszyscy wymienieni Autorzy pracy przeczytali ją i zaakceptowali skierowanie jej do druku.

Przeciwdziałanie nierzetelności naukowej - „***ghostwriting***" oraz „***guest authorship***";

· źródło finansowania publikacji:.....

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· podmioty, które przyczyniły się do powstania publikacji i ich udział:

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· wkład Autora/Autorów w powstanie publikacji (szczegółowy opis z określeniem ich afiliacji):

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Imię i nazwisko	**podpis**	**data**
1.....	**.....**	**.....**
2.....	**.....**	**.....**
3.....	**.....**	**.....**
4.....	**.....**	**.....**

Imię, nazwisko, adres, telefon, e-mail, osoby odpowiedzialnej za wysłanie niniejszego oświadczenia (głównego Autora pracy):

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Załącznik nr 2.

DEKLARACJA KONFLIKTU INTERESÓW

Konflikt interesów* ma miejsce wtedy, gdy recenzent ma powiązania, relacje lub zależności przynajmniej z jednym z autorów pracy, takie jak na przykład zależności finansowe (poprzez zatrudnienie czy honoraria), bezpośrednie lub za pośrednictwem najbliższej rodziny.

Tytuł pracy......

Data......

Konflikt nie występuje

Recenzent oświadcza, że nie ma powiązań ani innych finansowych zależności wobec Autora/Autorów:

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Podpis recenzenta

*** Recenzent oświadcza, że występuje następujący konflikt interesów**

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Podpis recenzenta:

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