CHAPTER 1
ECOLOGY

ENVIRONMENTAL ASSESSMENT OF SURFACE WATERS OF THE AREA OF EXTRACTING SULFUR BY YAVORIV DGKHP «SIRKA» LVIV AREA

V. Snitynskyy, Doctor of Biology, O. Zelisko, Ph D in agriculture,
P. Khirivskyi, Ph D in Biology, O. Mazurak, Ph D in Engineering,
A. Buchko, Ph D in Biology, Yu. Korinets, Ph D in Biology
Lviv National Agrarian University
P. 3–5. Bibl. 4.

Introduction. Stripping of Yaziv sulphur fields of Yavoriv state mine – chemical enterprise (SMCE) "Sirka–provoked dramatic changes in the landscape of Yavoriv district Lviv region which resulted in formation of technogenic landscapes with violated hydrological conditions. Karst concentration in ore-intensive water – carrying complex and its gigantic water- inflowings into open pit (at the early stage of sulphur deposits stripping it equalled 65.000 $м^3$/a day and gradually increased to 110–150.000 $м^3$/a day).

Analysis of last researches and publications. Mine strippings violate environmental hydrogeology and provoked the growth of run-offs of ore-intensive and mine waters containing quite a number of pollutants (chloride compounds, chamber sulphur acid, soluble salts, manganese, copper, zink, nickel, etc.). The most dangerous of them are hard metals: cadmium, molybdenium, nickel, zink, vanadium, tellurium, beryllium, mercury selenium, arsenic, lead.

Objectives. Ecological research of the surface waters within Yavoriv SMCE "Sirka" of Lviv region in 2014–1016 is aimed at complex study of chemical contents of the Shklo-river and scientific grounding of measures and directions of ecological and water balance of anthropogenically violated lands of Yaziv sulphur mine.

Main presentation. The given researched arrived at the conclusion that the inflow of the drainage waters of the pit and plaster waters of the mine of underground sulphur production within the Shklo – river system resulted in pollution of surface and ground waters with sulphates – 1,2 of maximal admissible concentration (MAC), phosphates – 1,76 of MAC, suspended materials – 1,42 of MAC, iron – 8,53 of MAC, nitrogen compounds – 1,38 of MAC, calcium – 1,16 of MAC, manganese – 3,4 of MAC, nitrates – 3,38 of MAC, solid residuals – 1,04 of MAC, mineralization – 1,11 of MAC.

Conclusions. The premises of sulphur deposits stripping and characterized be decreasing of the ground water level because of formulation of leuco-like cavities which cause source waters losses, decrease of water level or water losses in the wells of households. Post- excavated zones in the premises of underground sulphur production were subjected to their filling with hot technological water formulated by the saturation of fresh-carrier with ore-soluble compounds.

Bibliographic list

1. Панас Р. Н. Агроэкологическая характеристика земель, нарушенных промышленными разработками самородной серы, и особенности их рекультивации / Р. Панас // Вопросы рекультивации земель в западном регионе Украины. – Львов : Львовский сельхозинститут, 1986. – 160 с.
2. Панас Р. М. Основи моніторингу та прогнозування використання земель / Р. М. Панас. – Львів : Новий Світ-2000, 2011. – 224 с.
3. Панас Р. М. Особливості рекультивації земель Передкарпаття, порушених промисловими розробками самородної сірки / Р. М. Панас // Вісник с.-г. науки. – 1987. – № 9. – С. 36–38.
4. Снітинський В. В. Біологічна рекультивація техногенних відвалів сіркодобувної промисловості Прикарпатського сірконосного басейну [Снітинський В. В., Гончар М. Т., Сабан Б. О.]. – Львів : ЛДАУ, 2005. – 87 с.

SCIENTOMETRICS IN ECOLOGY: IMPORTANCE, OBJECTIVITY, MORAL AND COMMERCIAL ASPECTS

P. Gnativ, Dr., O. Zynyuk, Ph.D., V. Balkovskyi, PhD, V. Lykhochvor, Dr., V. Lypchuk, Dr., I. Shuvar, Dr., N. Kachmar, PhD, B. Krektun, PhD
Lviv National Agrarian University
P. 6–15. Bibl. 10.

The brief review of international scientometric databases for ranking scientists has been carried out. These bases allow identifying the popularity or authority of scholars, periodic journals and scientific publications.

The groups of ISI Web of Knowledge bases by Thomson Reuters corporation is considered as the most popular. Web of Science includes not only such important data bases as Social Science Citation Index, Science Citation Index Expanded, Arts and Humanities Citation Index, Book Citation Index but also contains a couple of bases from other field of knowledge.

It is considered that the database groups of Elsivier corporation which contain the Scopus base are second most powerful database group. This base has an instrument for scientific and practical publications citation monitoring.

Google Scholar database is searching system indexing whole text of scientific publications in all field of knowledge. It includes most peer-reviewed online journals of leading scientific editions.

Nowadays most popular among Ukrainian scientific editions are Poland database named Index Copernicus International. Simultaneously, in the world are some other databases, in particular: РІНЦ, Ulrich's, EBSCO, Serials, Solutions, NSDL, Ovid LinkSolver, DOAJ, Socolar, Cabell's Directories, Econlit, CiteFactor, Research Papers in Economics, Research Bible and other.

The majority of international rating databases are not available to the public, including public institutions because the excessive commercialization of information and lack of funding for such needs have taken place. Ukrainian scientists, educational and

scientific institutions have to possess the special budget for establishing their ratings, volumes of citing and so on.

The publications of Ukrainian scientists and teachers in spite of the topicality and global relevance, regional or even national innovations are not accessible to publication due to excessive commercialization of scientific papers issuing. Not only low level of professional articles and books but also the corporative barriers and lack of interest for supporting of publisher's ideas is the cause of barrier for successful publications.

Consequently, successful operation of scientometric bases for self-assessment and official or corporate rating of scientist needs to clarify the answers to the following questions:

a) In what extent the evaluative base is financially accessible?

b) In what extent the financially accessible and popular is an edition that can publish an article of the scientist, which it will be evaluated for different needs?

c) How objective is an rating approach to scientist, taking into account subjectivity of different tools and databases?

d) Does exist possibility of objective evaluation of scientific work which provide different in strictness and quality international scientometric databases due to applying accessible tools?

Does possibly for imperfect and subjective modern system of scientific work (studies, monographies) evaluation to be criterion of material compensation granting, position, degrees and titles ?

Another problem consist in that the most proficient in the some field scientist improving own citation index not always can publish his/her scientific work in the appropriate journal or country where this work will be presented to a lot of specialists which need it and make citations.

Bibliographic list

1. Діденко Ю. В. Представлення журналів НАН України у світових наукометричних базах / Ю. В. Діденко // Наука України у світовому інформаційному просторі. – К. : Академперіодика, 2011. – Вип. 5. – С. 77–80.

2. Иванов А. Б. Технологии увеличения индекса Хирша и развитие имитационной науки [Электронный ресурс] / А. Б. Иванов, В. Г. Петров. – Режим доступа : http://klnran.ru/wp-content/uploads/2016/04/BVZN_17.pdf.

3. Корній В. В. Наука Західного регіону України: статистика та інформаційне середовище / В. В. Корній, О. Д. Зинюк, Р. Р. Романюк // Наука України у світовому інформаційному просторі. – 2008. – Вип. 8. – С. 98–106.

4. Мрихіна О. Б. Міжнародні наукометричні бази даних: види та особливості [Електронний ресурс]. – Режим доступу : http://www.perspektyva.in.ua /naukovyj-prostir/porady-naukovtsyu/mizhnarodni-naukometrychni-bazy-danyh/.

5. Рейтинг університетів за показниками Scopus 2016 року [Електронний ресурс]. – Режим доступу : http://osvita.ua/vnz/rating/51053/.

6. About Google Scholar [Electronic resource]. – Mode of access : http://www. webcitation.org/66 WrkMawI.

7. Elsevier / Scopus / An eye on global research [Electronic resource]. – Mode of access : http://www.elsevier.com/online-tools/scopus.

8. Petrescu-Mag I. V. Scientometrics and relevant bibliographic databases in the field of aquaculture [Electronic resource] / Petrescu-Mag I. V., Oroian I. G. // Lucrări Ştiinţifice-Seria Zootechnie. – 2013. – Vol. 59. – P. 230–234. – Mode of access : http://dnsgb.com.ua/ scientometrics.html.
9. IC Journal Master List [Electronic resource]. – Mode of access : http://journals. indexcopernicus.com /index.php?lang=en_US.
10. Google Scholar Citations: Академія: Гнатів П. С. Приблизна кількість результатів [Electronic resource]. – Mode of access : https://scholar.google.com.ua/scholar?hl= uk&as_ sdt=0,5&q1.

NITRATES CONTAMINATION IN AGRICULTURAL WATER

N. Voitovych, candidate of agricultural sciences
Lviv National Agrarian University
O. Kharkhalis, leading specialist
Lviv branch of State University "State Soil Conservation"
P. 15–19. Bibl. 10.

Setting the problem. Growing pollution of rivers, lakes and underground water has become a wide-scaled problem of nowadays. Nitrate contamination is one of most widely spread drinking water pollutions. Nitrates solely are common component of a cell. However, their surplus is harmful and may lead to strong poisoning. Consuming nitrate-contaminated water weakens our immunity, causes methemoglobinemia.

Analysis of recent researches and publications. The problem of nitrate contamination in the sources of non-central water supply arose in the second part of the 20^{th} century, and nitrates were considered lightly toxic chemical composition up until recently. In the process of consuming products and water with nitrate surplus quantity, human organism receives not only nitrates but also metabolites. The latter are known to have cancer-causing and mutagenic impact, and are especially dangerous to babies, elderly people, and people suffering from anemia, respiratory problems or cardiovascular problems.

Non-controlled consuming of gardening fertilizers, soil pollution with waste water, architectural faults while designing residential areas, low ecological culture of the residents are the main reasons for nitrate contamination in subsoil water and water-carrying horizons.

Setting the goal. The aim of our research is to study the evaluation of nitrate contamination in water objects as well as water quality in the water samples taken from water sources within Lviv region.

Introducing the main material. Two hundred and sixty (260) water samples have been taken and analyzed by Lviv branch of State University "State Soil Conservation" during 2011–2015.

In our opinion, the reason for nitrate contamination in well water is, mainly, in their location close to household buildings, and in their unsanitary surrounding. The cause

of nitrate reaching well water may be their neighboring with waste basins, through which waste water alongside with nitrogen compositions leaks, invigorating thus nitrate capacity of sub-arable layers of soil.

Subsoil water contain, as a rule, less degree of nitrates than surface water, since soil serves a kind of "filter" throughout the way of nitrogen passing, the deeper subsoil water go, the less proportion of nitrates they contain. The research revealed nitrate surplus quantity in wells in the village of Obroshyno, Pustomyty district and village of Zavydovychi, Horodotskyi district.

The observed and recorded pollution is particularly dangerous since it was detected in well water, i.e. the water people drink every day and use for all their everyday needs. Nitrates are proved to have extremely negative influence on human organism. They have an impact on genetic mechanisms, cause cardiovascular diseases, metabolic changes, etc. Concentration of nitrate in drinking water 50 mg/l may cause blood diseases in children as well as young animals, and its constant intoxication, even in small doses, may lead to metabolic changes. Moreover, since nitrates are compulsory component of household and farm wastes, they serve thus as indirect index of bacterial pollution of subsoil water.

Conclusions: In the result of the research, nitrate surplus quantity was detected in wells in the village of Obroshyno, Pustomyty district and the village of Zavydovychi, Horodotskyi district. It is necessary to ensure local and regional monitoring over natural and waste water content and to establish scientifically proved standards for nitrate proportion in all the types of water to prevent from nitrate surplus accumulation in natural water, to provide water reservation and foresee water quality alterations.

Bibliographic list

1. Валерко Р. А. Обґрунтування заходів щодо підвищення якості питної води джерел нецентралізованого водопостачання сільських населених пунктів в умовах Житомирської області / Р. А. Валерко, Л. О. Герасимчук // Сучасні проблеми збалансованого природокористування : спец. вип. до IX наук.-практ. конф. (листопад, 2013 р.). – Житомир, 2013. – С. 209–212.

2. Вишневський В. І. Річки і водойми України. Стан і використання / В. І. Вишневський. – К. : Віпол, 2000. – 245 с.

3. Грюк І. Вміст сполук нітрогену у воді малих річок як показник рівня антропогенного навантаження територій / І. Грюк // Вісник Львівського університету : Серія біологічна. – Львів, 2012. – Вип. 60. – С. 227–238.

4. ГОСТ 18826-73. Вода питьевая. Метод определения содержания нитратов. – М. : ИПК Изд-во стандартов, 2003. – 7 с.

5. Медико-екологічна проблема сумарного надходження нітратів в організм людини з питною водою та харчовими продуктами та шляхи її вирішення / [Ю. Г. Бондаренко, І. В. Хоменко, Л. І. Білик, О. С. Джулай] // Актуальные вопросы транспортной медицины. – 2011. – № 1(23). – С. 82–86.

6. Методические указания по определению нитритного азота и нитратов в почвах, природных водах, кормах и растениях. – М., 1984. – 24 с.

7. Методичні рекомендації з агроекологічного моніторингу селітебних територій / за ред. Н. А. Макаренко. – К., 2005. – 26 с.

8. Смоляр В. І. Нітрати, нітрити та нітрозоаміни у харчових продуктах і раціонах [Електронний ресурс] / В. І. Смоляр, О. І. Цыганенко, Г. І. Петрашенко // Проблеми

харчування. – 2007. – Режим доступу : http://www.medved.kiev.ua/arh_nutr/art_2007/n07_3_5.htm.
9. Снітинський В. В. Екотоксикологія / [Снітинський В. В., Хірівський П. Р., Гнатів П. С. та ін.]. – Херсон : Олді-плюс, 2011. – 300 с.
10. Соколов О. А. Нитраты в окружающей среде / О. А. Соколов, В. М. Семенов, В. А. Агаев. – Пущино, 1990. – 317 с.

ENVIRONMENTAL PROTECTION MEASURES FOR THE PERENNIAL TREES OF DUBLYANSKY MONUMENT PARK OF LANDSCAPE ART

V. Snitynskyy, P. Khirivskyy, H. Lysak
Lviv National Agrarian University
P. 20–24. Bibl. 8.

Problem statement. On September 15, 2015 Lviv National Agrarian University Arboretum received the status of a protected object – Dublyansky Monument Park of Landscape Art. The problem of protection of perennial trees' health aged 100–160 years has emerged. These trees have a special historical, scientific and cultural significance.

However, the negative anthropogenic impact, environmental pollution affect the sanitary condition of the trees and shrubs of the park. 36% of trees are affected by various diseases. It is necessary to carry out a range of measures to support them in this condition.

Objective of the research. The aims of this study were to determine the number of perennial trees in Dublyansky park; ascertain their sanitary condition, age, compile the inventory list and provide recommendations for the protection of perennial trees in an artificial phytocenoses.

To solve these problems, the following methods were used: visual reconnaissance method, forestry method, biometric method, geodetic and cartographic methods, statistical method [4].

The main results of the research. In Dublyansky Monument Park of Landscape Art (PPSPM) 1808 trees and 237 shrubs grow [4]. The taxonomic structure of the park is represented by 97 species of arboreal and shrubby plants. 72 of them – coniferous and deciduous trees (74%), 24 species – coniferous and deciduous shrubs (25%).

According to the method of A.G. Voronova (1973) perennial trees are those which have reached the age of 100 or more. In Dublyansky Park there are 20 specimens. The results of the survey show that such perennials as the Scotch elm, ginkgo tree, walnut, small-leaved linden, and common ash have reached the age of 120. About 10 specimens of oak common are at the age of 120–160. Only one representative of the common beech is 140 years old. The old residents of the park are white mulberry and oak common that have been growing for 160 years.

Except mentioned perennials, there are several trees that are on the verge of a hundred years old, including eastern black walnut (Juglans nigra L.), horse-chestnut (Aesculus hippocastanum L.), Norway maple (Acer pseudoplatanus L.), sycamore (Acer

pseudoplatanus L.), European larch (Larix decidua Mill.), buttonwood (Platanus occidentals L.), the Norway spruce (Picea excelsa Link.).

The study of the sanitary condition of the park trees indicates about 30% of the affection of them by the phytogenic parasite – the mistletoe, from the total amount of arboreal and shrubby vegetation.

The sanitary condition of the perennials is good or satisfactory. Only a few representatives of small-leafed linden and common beech are in an unsatisfactory condition due to the presence of stem rot and mechanical damage.

The perennials of our park require constant monitoring of their condition and protection. Branches of such trees need to be pulled together and propped up. To minimize the risks, the chemical pest control should be taken, the fertilizer should be applied, foliar top dressing and restoration of the natural grass cover around the trunk sections should be carried out. If necessary, the installation of the lightning-rods can be done to prevent lightning strikes from hitting the tree. The close access of visitors to such trees should be limited and their trunk space should be enclosed by a small fence. An information board about the tree and its status should be placed near the perennials. The construction should be forbidden and the communications cannot be laid near such trees.

Conclusion. All the perennials require our increased attention, constant care and observation of their ecological and sanitary condition. Considering the special location of the park which is surrounded by educational buildings, we must ensure the optimal functioning of the protected object, recreation, walking areas and economic zones of the university. Besides this, first of all we should comply with control measures to protect the perennials.

Bibliographic list

1. Снітинський В. В. Паркові насадження Львівського державного аграрного університету / В. В. Снітинський, М. Т. Гончар, Б. О. Сабан. – Львів : ЛДАУ, 2001. – 27 с.
2. Біографічно-бібліографічний довідник : Львівський державний аграрний університет в іменах : науково-педагогічний склад у 1946–2006 роках / за заг. ред. Г. Барабаш. – Львів : Новий світ, 2006. – 390 с.
3. Бібліографічний словник (1856–1947) : Професори, доценти та асистенти навчально-наукових установ у Дублянах / [авт.-уклад. Токарський Ю. М.]. – Львів, 2004. – 119 с.
4. Розроблення проекту утримання та реконструкції парку-пам’ятки садово-паркового мистецтва «Дублянський» : звіт про науково-дослідну роботу / [Кагало О. О., Козловський М. П., Сичак Н. М. та ін.] ; за заг. ред. О. О. Кагало. – Львів : Інститут екології Карпат НАН України, 2016. – 71 с.
5. Au Ju. Ogród botaniczny / Au Juliusz // Roczniki Krajowej Wyższej Szkoły Rolniczej w Dublanach. – Lwów, 1888. – 171 s.
6. Miczyński K. Ptaki Dublan (Ukraińska SRR). Acta ornithologica / K. Miczyński. – Warszawa : Instytut zoologiczny PAN, 1962. – T. IV, № 10. – S. 120–178.
7. Pawlikowski J. Ogród botaniczny. Dublany. (Szkoły i Zakłady krajowe w Dublanach) / Pawlikowski Jan. – Lwów, 1937. – 143 s.
8. Raciborsky M. O zadaniach współczesnych ogrodów botanicznych i ogrodzie dublańskim / M. Raciborsky. – Lwów, 1902. – 45 s.

FEATURES OF TRANSFORMATION OF STABLE ORGANIC POLLUTANTS IN THE SOIL

M. Ivankiv, V. Balkovskyi, S. Pavkovych
Lviv National Agrarian University
S. Vovk
Institute of Agriculture of Carpathian region NAAS
P. 24–29. Bibl. 9.

Formulation of the problem. The soil pollution by persistent pesticides in the locations of old warehouses with unsuitable agrochemicals is an urgent problem that needs to be addressed. The clearing of soil from dangerous for human health and the environment of xenobiotics is a necessary measure in the system of improvement of the ecological situation in Ukraine. An important task is to study the detoxification and migration of toxicants in the soil for the development of safe and economically justifiable methods of remediation of pesticide-polluted areas.

Presenting main material. The research was carried out on a dark gray, podzolized soil on the territory of the sanitary zone of the non-operating composition of agrochemicals in the villages Glinsko and Vyazova of Zhovkva district in conditions of the Western forest-steppe of Ukraine. The analysis of soil samples was carried out at the State Institution "Soils Protection Institute of Ukraine" in Lviv. The research was carried out in accordance with existing regulations and "Methodological Guidelines for the Determination of the Quantity of Pesticides in the Food, Feed, and Environment". The content of organochlorine pesticide residues was determined by the gas-liquid chromatography method approved by the Ministry of Health on a gas chromatograph "Crystal-2000". The maximum concentration of DDT in the soil is 100 μg/kg.

The obtained data were processed by statistical methods using the program Statistica-10 and the package of Microsoft Excel applications.

The percent ratio of isomers and DDT metabolites in the soil of the non-active zone of agrochemicals sanitary zone in the village Glinsko of Zhovkva district was calculated. This ratio indicates the long-term pollution of the soil by the given xenobiotic and the passing of its strongly expressed transformation. Almost all agricultural land, most of the metabolites of DDT are 4,4'-DEE.

Despite the antiquity of the toxicant, there is still a certain amount of non-metabolized 4,4'-DDT in the soil. The larger content of DDE than DDD indicates a predominantly anaerobic mechanism for the transformation of DDT.

The percent ratio of isomers and DDT metabolites in the soil of the non-active zone of agrochemicals sanitary zone in the village Vyazova of Zhovkva district was calculated.

The results of the research showed that in all selected samples of soil, the main part consists of 4,4'-DDE (53%) and 4,4'-DDD (29%), the smallest – 4,4'-DDT (18 %). Such content of isomers and metabolites DDT speaks of the process of intensive transformation of a pesticide and of the long-term soil contamination with this xenobiotic.

In order to obtain reliable data on the patterns of distribution and features of physical and chemical migration of organochlorine pesticides and their derivatives in soils, it is necessary to study and research the natural environment in a holistic way, at all levels of the organization. The task of urgent organization of agroecological monitoring on areas that have reached a critical state becomes completely understandable. Therefore, it is relevant to carry out an ecotoxicological assessment of the soil of the sanitary zones of the compositions of agrochemicals on the content of persistent organochlorine pesticides.

Conclusions. On the example of two thrown warehouses, located in the zone of the Western Forest-steppe, zones of increased man-made load were revealed. The migration of organochlorine pesticides in the lower layers of the soil occurred irrespective of the level of soil contamination with pesticide residues, organochlorine pesticides were found at depths up to 1 m in the profile of dark gray podzolized soil.

The results of the studies indicate that the soil cover remains contaminated with residual organic chlorine-based pesticides. The permanent presence and migration of pesticide residues in the soils of their local storage area are due to the physical and chemical properties of both the toxicant and the medium of its spread, as well as to the persistence and factors that determine the emission and mass transfer of xenobiotics and testify to the urgency of the problem of soil contamination of the sanitary zones of the warehouses of agrochemicals by prohibited organochlorine pesticides and the need to develop methods of remediation of contaminated areas.

Bibliographic list

1. Методичні вказівки з визначення мікрокількостей пестицидів у харчових продуктах, кормах та навколишньому середовищі. – К., 2005. – 246 с.
2. Методичні рекомендації з агроекологічного моніторингу територій, забруднених стійкими органічними забруднювачами / [О. І. Фурдичко, Л. І. Моклячук, О. А. Никитюк та ін.]. – К. : Мінагрополітики, 2010. – 32 с.
3. Методичні рекомендації з комплексної оцінки ступеня хімічної деградації ґрунтів / [О. І. Фурдичко, Л. І. Моклячук, О. А. Никитюк та ін.]. – К. : Мінагрополітики, 2010. – 35 с.
4. Методы определения микроколичеств пестицидов в продуктах питания, кормах и внешней среде : справочник. – Т. 1-2 / сост. М. А. Клисенко, А. А. Калинина, К. Ф. Новикова и др. – М. : Колос, 1992. – 567 с.
5. Особливості міграції та акумуляції хлорорганічних забруднень у ґрунті / [М. Я. Іванків, С. О. Вовк, В. В. Бальковський та ін.] // Вісник Львівського національного аграрного університету : агрономія. – Львів : Львівський національний аграрний університет, 2016. – № 20. – С. 18–22.
6. Склади зберігання непридатних та заборонених до використання хімічних засобів захисту рослин – джерело небезпеки для навколишнього середовища / [Л. І. Моклячук, Ю. С. Баранов, І. М. Городиська та ін.] // Збірник наукових праць Вінницького національного аграрного університету. Сільськогосподарські науки. – Вінниця, 2012. – Вип. № 1(57). – С. 65–69.
7. Фурдичко О. І. Агроекологія : монографія / О. І. Фурдичко. – К. : Аграр. наука, 2014. – 400 с.
8. Ivankiv M. Ya. Accumulation of organochlorine pesticides in vegetation around of places of their storage / M. Ya. Ivankiv, S. O. Vovk // Folia Pomeranae Universitatis Technologiae

Stetinensis, Agricultura, Alimentaria, Piscaria, et Zootechnica. – Szczecinie, 2014. – № 315(32). – P. 15–20.
9. Ivankiv M. Ya. The contens organochlorine pesticides in soils near its their warenhouse / M. Ya. Ivankiv, S. O. Vovk // Srodowiskowe zagrozenia zdrowia ludzi i zwierzat: Konferencyia naukowa dedykowana pamieci Pana prof. dr hab. Alojzego Ramisza / Zachodniopomorski Uniwersytet Technologiczny w Szczecinie, 18 listopada 2011. – Szczecin, 2011. – S. 20–22.

CHAPTER 2
SOIL CULTIVATION

THE ENZYME ACTIVITY OF TYPICAL CHERNOZEM IN DIFFERENT SYSTEMS OF SOIL CULTIVATION AND FERTILIZING FOR SPECIALIZED CROP ROTATION

I. Primak, O. Panchenko, I. Panchenko
P. 30–38. Bibl. 8.

Target setting. Soil ferments are biological catalysers of plant and animal residues transformation. Soil fermentation activity according to V.F. Kuprevych, T.O. Shcherbakova is "the most significant index of soil bioactivity" [1]. Due to the fact that the source of soil ferments is a complex of all its living organisms, generally fermentation activity reflects the intensity and targeting of biochemical processes in soil and it can be an indicator of its biota`s state [2].

It has been established that the degree of soil invertase activity is quite inconstant and it depends on a method and depth of soil tillage operations and its fertilization. Under a surface and especially lasting tillage, the localization of plant residues in the top of a plow layer (0–10 cm) provides increasing of invertase activity to 8–18 % in comparison with a plowing to 20–22 and 25–27 cm. The invertase activity of a bottom plow layer (10–20 and 20–30 cm) is correspondently 4–10 and 15–28 % higher under a plowing rather than under a heavy disc harrow. In the whole crop rotation, the invertase activity of a plow layer under a differential and lasting surface tillages is correspondently 1,3–1,5 and 3,1–7,3 % higher than under a lasting beard tillage. Under a constant beardless tillage this index is appeared to be 1,3–1,5 % lower than on the watch list.

It has been noticed that invertase activity has a seasonal character and it increases from May to July. It is connected with a corresponding growth of a root system, increasing of a soil temperature and a number of living microorganisms.

Catalase activity under a differential and a lasting surface tillage is correspondently 0,9–1,3 and 1,9–3,0 % lower, and under a constant subsurface cultivator loosening is 4,2–6,7% higher than on the watch list. It resulted in corresponding changes in humus content in the soil. Thus, on the nil treatments and together with applying of 4 t of pus on 1 ha of a tilled field in a crop rotation + $N_{26}P_{44}K_{44}$, annual loss of humus in a

plow layer during 2004–2014 was correspondently 0,67 and 0,21 t under a lasting beard tillage, 0,82 and 0,35 t under a constant subsurface cultivator tillage, 0,42 and 0,12 under a differential tillage, 0,38 and 0,08 t under a lasting surface tillage. Statistically verified increase of humus content in a plow layer during two crop rotations is noticed only under the highest level of fertilization and under a differential and lasting surface tillage.

A surface tillage in comparison with a plowing causes a significant increase of a protease activity of the top of a plow layer (0–10 cm). It has been noticed that protease activity of the bottom of a plow layer (20–30 cm) of a black soil on the areas tilled with a plough is much higher than on the areas tilled with a harrow. Protease activity of a plow layer is decreasing with a decreasing of the intensity of tillage operations. This index was 4,7–8,2 % lower than on the watch list under a lasting surface tillage.

Among hydrolytic ferments whose activity is connected with a formation of accessible fertilizer elements in the soil, the considerable role belongs to phosphatases. Soil phosphatases take direct part in organic residues decomposition processes in a soil that leads to a formation of organophosphorous compounds such as phosphorous aether of carbonhydrates, organic acids, lipids, phytins and specific humus substances. This group of compounds forms accessible for plants orthophosphorous acid.

Reactions of hydrogen abstraction from organic compounds of the soil (dehydration) are catalyzed by dehydrogenases, which are also transitional hydrogen carriers. Different carbohydrates, aromatic acids, amino acids, spirits, humic acids can be the substrates of dehydration in a soil. Dehydrogenases of carbonhydrates and organic acids are very active in the soil, and abstracted hydrogen in the course of dehydration can be transmitted to ambient oxygen or to organic substances like kinones. Oxidation process of mentioned above organic compounds occurs both during mineralization of organic residues and the formation of specific humus substances in the soil.

Conclusion

1.The highest activity of invertase, urease, dehydrogenase and polyphenol oxidase of a plow layer of a typical black soil is under a lasting surface tillage. Higher activity of phosphatase, peroxydase and catalase were noticed under systematic subsurface cultivator tillage.

2. Protease activity of a plow layer is decreasing due to the decreasing of the intensity of tillage. Under a surface tillage, localization of plant residues in the top of a plow layer (0–10 cm) causes the increase of fermentation activity of a black soil. The lowest indices of invertase, urease and protease activity of a plow layer are noticed under a systematic beardless tillage.

3. The highest coefficient of humus accumulation is under a lasting surface tillage and the lowest one is under a constant subsurface cultivator tillage.

4. In a specialized field five course grain row crop rotation a deep arable plowing (to 25–27 cm) is recommended in one field and in the other fields a surface tillage to 10–12 cm is recommended.

Bibliographic list

1. Купревич В. Ф. Почвенная энзимология / В. Ф. Купревич, Т. Д. Щербакова. – Минск : Наука и техника, 1966. – 276 с.

2. Галстян А. Ш. Ферментативная активность почв Армении / А. Ш. Галстян. – Ереван : Атастан, 1974. – 174 с.
3. Хазиев Ф. Х. Ферментативная активность почв / Ф. Х. Хазиев. – М. : Наука,1976. – 179 с.
4. Агрохімічний аналіз : підручник / [М. М. Городній, А. П. Лісовал, А. В. Бикін та ін.] ; за ред. М. М. Городнього. – К. : Арістей, 2005. – С. 262–272.
5. Грицаєнко З. М. Методи біологічних та агрохімічних досліджень рослин і ґрунтів / Грицаєнко З. М., Грицаєнко А. О., Карпенко В. П. ; за ред. З. М. Грицаєнко. – К. : ЗАТ «Нічлава», 2003. – 316 с.
6. Петренко Л. Р. Зміна біологічних властивостей ґрунтів під впливом обробітку ґрунту без обертання скиби / Л. Р. Петренко, В. А. Андрієнко, Н. М. Рідей // Відтворення родючості ґрунтів у ґрунтозахисному землеробстві. – К. : Оранта, 1998. – С. 122–144.
7. Вильямс В. Р. Почвоведение. Земледелие с основами почвоведения / В. Р. Вильямс. – М. : Сельхозгиз, 1946. – 456 с.
8. Гречин И. П. Некоторые итоги и дальнейшие задачи изучения кислородного режима почв / И. П. Гречин // Изв. ТСХА. – 1970. – Вып. 1. – С. 103–110.

CHAPTER 3
CROP GROWING

YIELD OF WINTER RAPE DEPENDING ON FOLIAR APPLICATION

V. Lykhochvor, I. Dudar, O. Lytvyn, M. Bomba, O. Dudar
Lviv National Agrarian University
P. 39–43. Bibl. 5.

Problem setting. Winter rape is a valuable food, forage and industrial crop, being in demand both at domestic and foreign market. It is an annual herb, which has large food, feeding and energy potential. Rape is grown in pure form and in combination with other crops for herbage, haylage, silage and grassy flour. Seed of rape is used for obtaining of seed oil, high-quality seed meal, protein meal, being high-quality fodder for all kinds of cattle and poultry, biodiesel fuel, i.e. renewable source of energy for internal combustion engines, etc. Ukraine is energy dependent country and domestic production of renewable sources of energy of rape oil is of great importance.

Creation of optimal conditions for development of plants and formation of maximal yield of rape with necessary characteristics is impossible without active improvement and strict keeping to all elements of the crop growing technology.

Optimization of nutrition conditions under certain economic conditions is the most important component of the technology of rape growing. Supply of plants with necessary complex of macro- and microelements is an essential condition to obtain high and sustainable yield of the crop with high indicators of quality.

Foliar application is the most efficient way to substitute lack of microelements.

Thus, study of the effect of liquid fertilizers of “Intermah” brand, developed for foliar application, is an actual issue.

Main material. Growing of high seed yield is connected with investigation of biological peculiarities of winter rape. Overwintering of plants is one of essential stages in technology of winter rape growing. Development of rape plants and yield level greatly depends on conditions of plants after winter period.

Winter rape is cold-season crop, but its winter resistance is weak and depends on its cultivar, temperature conditions, plant hardening and agrotechnical measures.

Low cold resistance of rape is caused by its morphological peculiarities. Root crown of rape rises above the soil and is very sensitive to low temperatures, and thus, has poor frost resistance.

Strict compliance of growing technology requirements is an important factor of rape winter resistance. Supply of rape plants with macro- and microelements in autumn period supports an optimal formation of root crown size, accumulation of sugars and soluble amino acids in cells.

Foliar application is the most efficient way to supply mineral elements during the whole vegetation period.

Subject of the research is made by winter rape and complex liquid fertilizer Intermah-Oil, containing micro- and macroelements in chelate form, available for plants. Fertilizer Intermah-Oil was foliar applied, by small drop method in the form of water solution according to the following scheme: 1. Control (water straying); 2. Intermah-Oil, 1 l/ha; 3. Intermah-Oil, 1 l/ha + Boron; 4. Intermah-Oil, 1/ha + Boron, 1,0 l/ha.

It is proved that autumn application of microelements increases number of leaves and thickness of root crown at winter start. Plants of control variant produced six leaves in average. Plants of the variants with applied fertilizers produced 7–8 leaves.

Our research confirms that foliar application of Intermah-Oil fertilizers for rape in the norm of 1 l/ha activates growth and development of root system in autumn and increases root crown up to 9,0 mm. However, combination of Intermah-Oil, 1 l/ha + Boron, 0,5 l/ha increases it up to 9,3 mm and Intermah-Oil, 1l/ha + Boron, 1 l/ha – up to 9,5 mm, comparing to the control variant of 8,1 mm.

Thus, autumn application of Intermah-Oil fertilizers supports development of plants, improves their winter resistance and provides earlier production of spring rosette.

Structure of rape yield is an important indicator. Application of mineral fertilizers makes positive effect on indicators of yield structure. Application of Intermah-Oil fertilizers increases number of pods at an oil plant and number of seed in it.

High yield of winter rape was demonstrated by the variants with foliar application. Comparing to the control, the highest growth of yield (3,2 hwt/ha) was obtained in the variant with application of Intermah-Oil 1 l/ha + Boron 1 l/ha. Good growth was also observed in the variants, where Intermah-Oil 1 l/ha + Boron 0,5 l/ha (2,8 hwt/ha) and Intermah-Oil 1 l/ha (1,9 hwt/ha) were applied.

Conclusions. Considering complexity of winter rape overwintering, as well as high probability of negative phenomena in spring vegetation period, we propose to implement autumn treatment of crops with fertilizer Intermah-Oil, 1 l/ha + Boron, 1 l/h at the stage of six leaves.

Bibliographic list

1. Абрамик М. И. Влияние агротехники и минерального питания на биоэнергетические и экономические показатели выращивания рапса озимого / М. И. Абрамик, Н. Н. Лис // Земледелие, растениеводство, селекция: настоящие и будущее. – Жодино, 2012. – С. 67–69.

2. Лихочвор В. В. Мінеральні добрива та їх застосування / В. В. Лихочвор. – Львів : Українські технології, 2008. – 312 с.

3. Лихочвор В. В. Ріпак / В. В. Лихочвор, Р. Р. Проць. – Львів : Українські технології, 2005. – 88 с.

4. Цехмейструк М. Г. Удобрення ріпаку – запорука доброго врожаю / М. Г. Цехмейструк // Agroexpert. – 2008. – № 3. – С. 8–14.
5. Щоткін В. Шляхи інтенсифікації вирощування ріпаку / В. Щоткін // Пропозиція. – 2006. – № 4. – С. 42–45.

FEATURES OF WEED INFESTATION OF WINTER WHEAT DURING GROWING WITHOUT CHANGING AND IN ITS PERMANENT ROTATION

V. Ivanyuk
Lviv National Agrarian University
P. 43–48. Bibl. 6.

Formulation of the problem. The intensification of agricultural production significantly affects the composition of a segetal vegetation. In particular, a significant effect has the simplification of crop rotation, making of high doses of nitrogen fertilizer, improved seed cleaning, change of herbicide load and more. Some weed species disappears from agrophytocenoses, others are evil weeds.

For saturation of crops rotation, observed increased weed infestation of evil weed as Elymus repens, Cirsium arvense, Apera spica-venti and types of chamomile, Lamium album, Viola and so on.

Presenting main material. The research conducted in the long-term (1964 inception) stationary experiment department, where we studied the performance of permanent crops winter wheat, potatoes, corn, sugar beets and winter rye. The areas of application of herbicides used Grodil Maxi – 0,1 l/ha.

The soil of research area is dark gray-ashed medium loam on loess loam. Agrochemical indexes of topsoil, humus content (by Turin) – 2.5%; alkaline hydrolysed nitrogen (by Kornfild) – 110 mg/kg; pH of saline (potentiometrically) – 5.2; hydrolytic acidity (by Kappen) – 2.8 water hardness on 100 g soil medium provided of movable phosphorus and exchangeable potassium.

In the western forest-steppe on dark gray-ashed soils often in winter wheat crops are found overwintering weeds: Apera spica-venti, Tripleurospermum inodorum, Papaver rhoeas, Myosotis arvensis. With perennial – Cirsium arvense. Thus, during the growing of wheat in crop rotation after normal vegetation of Apera spica-venti was 14.6 pieces/m^2 or 19.8 %, Stellaria media 11.4 or 15.5 %, Tripleurospermum maritimum 10.9 or 14.8 %, Galeopsis tetrahit 12.7 pieces/m^2, representing 17.2 % of in species composition.

During the growing of wheat in permanent rotation against the background of organo-mineral fertilizer system and a making of herbicide, weediness increased to 154.5 pieces/m^2, or more than twice. In crops dominated Apera spica-venti – 49.9 pieces/m^2 (32.2 %), Tripleurospermum inodorum – 33.1 (21.4 %), Papaver rhoeas – 26.1 (16.9 %), Myosotis arvensis and Centaurea cyanus 12.2 pieces/m^2 or 7.9%. Not set spreading of Galeopsis tetrahit, Thlaspi arvense, Capsella bursa-pastoris and Fumaria officinalis.

For mineral fertilizer system of permanent crops of wheat, weed density is higher in 5,1–8,9 % versus organo-mineral system and weediness in no herbicidal options increases by 15,3–18,2 %.

The crop capacity reflects good soil fertility and allows evaluating the effectiveness agricultural activities. On average for the years 2014–2016 version of the study on organic-mineral fertilizer system permanent crop yield of winter wheat was 30.6 and 38.3 c/ha, which 6,2–10,1% higher than only making fertilizers in mineral form.

The placement of winter wheat in rotation provides a surplus yield of 17.8 c/ha, which is 31.7 % without additional costs.

Conclusions. In the western steppes of Ukraine, the growing of winter wheat crop rotation promotes to reduce weed density more than doubled compared with long-term re-cultivation. Provided monoculture of the wheat crop is appropriate to use organic-mineral fertilizer system of cultivation technology. The crop capacity of winter wheat in crop rotation increases by 17.8 %, or almost 32%.

Bibliographic list

1. Политыко П. М. Роль севооборотов в системе защиты сельскохозяйственных культур от комплекса вредных организмов / П. М. Политыко //Агро XXI. – 1999. – № 2. – С. 16–18.
2. Сафонов А. Ф. Длительному полевому опыту ТСХА 90 лет: итоги научных исследований / А. Ф. Сафонов. – М. : Изд-во МСХА, 2002. – 262 с.
3. Сорока В. Ф. Интегрованные системы защиты сельськохозяйственных культур от вредителей, болезней и сорняков / В. Ф. Сорока. – Минск : Белорусская наука, 2005. – 462 с.
4. Томашівський З. Озиме жито та кукурудза в беззмінних посівах / З. Томашівський, В. Грицик, О. Волинець // Вісник ЛДАУ : агрономія. – 2002. – № 6. – С. 46–50.
5. Шпаар Д. Зерновые культуры: выращивание, уборка, хранение и исследование / Д. Шпаар. – К. : Изд. дом «Зерно», 2012. – 704 с.
6. Шувар І. А. Наукові основи сівозмін інтенсивно-екологічного землеробства / І. А. Шувар. – Львів : Каменяр, 1998. – 224 с.

YIELD CAPACITY OF MAIZE HYBRIDS, DEPENDING ON NUTRITION AREA UNDER CONDITIONS OF THE WESTERN FOREST-STEPPE

M. Bomba, Candidate of Agriculture (PhD), I. Dudar, Candidate of Agriculture (PhD),
O. Lytvyn, Candidate of Agricuture (PhD),
O. Tuchapskyi, Candidate of Agriculture (PhD), A. Kotsiuba, master degree student
Lviv National Agrarian University
Yu. Hrynda, chief agronomist of LLC "Ahro-Ros", Pidvolochysk district, Ternopil region
P. 48–51. Bibl. 5.

Problem setting. Maize is an important fodder and food crop. It is the most spread crop in the global arable farming. Among cereals, maize takes the second position by its gross yield and the third position by its yield capacity. 60 % of the total world production of maize grain are used as forage for animals, above 25 % – as food product, and the rest – for industrial processing and production of oil, starch, sugar, spirit and glucose. At the world market, demand for maize grain is getting higher. It is caused by its

processing for bioethanol. Besides, not just grain, but also the whole biomass is processed for obtaining of a new biofuel, i.e. methane. Development of production of alternative sources of energy opens new prospects for maize at Ukrainian market and expansion of its cropping area in all favorable regions.

Main material. Increase of the density of over 70 thousand plants per one hectare causes a longer vegetation period, i.e. by 3–4 days, for the both studied hybrids. Vegetation period of the early ripe Tsisar hybrid is 10–11 days shorter than the period of vegetation of the medium early Mateus hybrid.

Under conditions of the Western Forest-steppe, thick planting of maize is accompanied by increase of the plants height. The average indicator of the two years has increased by 17–20 cm, depending on the hybrid. Similar to the increase of plants height, height of attaching of the lowest productive cob also increased by 11 and 9 cm in Mateus and Tsisar hybrids respectively.

Analysis of structural indicators of the maize hybrids yield proves that increase of crops density results in a clear trend to their less yield, regardless of the hybrid. Particularly, in Mateus and Tsisar hybrids, increase of crop density from 60 to 90 thousand per a hectare caused decrease of the number of maize cobs by 43 and 47 units, counted on 100 plants.

Higher density of crops negatively influences weight of grain in one plant, having decreased it by 21,0 and 46,5 g in Mateus and Tsisar hybrids respectively. Grain output decreases by 2,4–2,8 %, as a result of crop density increase from 60 to 90 thousand per a hectare, depending on the hybrid. Higher density of crops causes decrease of the weight of 1000 grain by 26 and 17 g in Mateus and Tsisar hybrids respectively.

However, analysis of grain yield proves that fall of individual productivity is not as substantial as increase of crop density of plants. Such tendency supports rise of general productivity of plants per a unit of area, i.e. causes rise of yield capacity of one hectare to a certain level of crop density. For the two years, the average indicators of yield capacity of Mateus and Tsisar hybrids, at optimal density of crops, i.e. 80 thousand per a hectare, made 100,8 hwt/ha of grain. The medium early hybrid Tsisar supplies the best yield capacity, i.e. 104,0 hwt/ha, at the density of 70 thousand of plants per one hectare.

Growing Mateus hybrid, the highest level of profitability (145,9%) is obtained in the variant with the crop density of 80 thousand of plants per one hectare, for Tsisar hybrid, the optimal density is 70 thousand per one hectare, and profitability level constitutes 155,7 %.

The best coefficient of energy efficiency was obtained in the variants, where a higher maize grain yield was formed. Thus, for Mateus hybrid, it was 5,01, at the crop density of 80 thousand of plants per one hectare, and for Tsisar hybrid, it was 6,14, at the variant of 70 thousand plants per one hectare.

Conclusions. Under conditions of Podillia in Ternopil region, the early ripe Mateus hybrid is reasonably to be grown at the crop density of 80 thousand, and the medium early Tsisar hybrid – at the crop density of 70 thousand per one hectare.

Bibliographic list

1. Зайцев О. Розширення площ вирощування зернової кукурудзи в Україні – нагальна потреба сьогоднішнього дня / О. Зайцев, В. Ковальов // Пропозиція. – 2003. – № 11. – С. 53.

2. Косарський В. Ю. Вплив густоти рослин на врожайність зерна кукурудзи в умовах східної частини Степу України / В. Ю. Косарський, О. Л. Грицун, С. О. Пантюшенко // Агроном. – 2010. – № 3 (серпень). – С. 70–72.
3. Андрієнко А. Густота як фактор продуктивності кукурудзи / А. Андрієнко, М. Романенко // Пропозиція. – 2013. – № 3. – С. 60–63.
4. Пащенко Ю. М. Продуктивність гібридів кукурудзи в технологічних системах / Ю. М. Пащенко, А. Л. Андрієнко, Ю. О. Пащенко // Вісник аграрної науки. – 2006. – № 1. – С. 19–22.
5. Бомба М. Я. Використаймо кукурудзу сповна / М. Я. Бомба, М. І. Бомба // Пропозиція. – 2001. – № 3. – С. 40–43.

PRODUCTIVITY OF OIL FLAX CROPS IN DIFFERENT SEEDING RATES UNDER CONDITIONS OF THE SOUTHERN PART OF THE RIGHT-BANK FOREST-STEPPE

L. Kononenko, candidates of agricultural sciences
Uman National University of Horticulture
P. 52–57. Bibl. 8.

The guaranteed providing of population with food is the most important task of the agricultural production in Ukraine. Oil crops are a source of valuable food and technical vegetable oils. Ukraine has favorable climatic conditions for the cultivation of oily raw material and certain technical possibilities for its processing and, therefore, not only meeting domestic needs in vegetable fats but its implementation on the international market.

Oil flax is a valuable nutritional and therapeutic plant. Flax seeds contain 50% oil. Its ability to dry out quickly, form a solid thin and flexible coating, is used for the production of special lacquers and enamels, as well as in medicine, food, electro technical and other industries.

Oil flax plants respond differently to certain technological methods in their cultivation. So, it was important for the southern Forest Steppe of Ukraine (Cherkasy region) to establish the formation pattern of oil flax yield depending on the seeding rate of seeds.

Research methods. Field experiments were conducted in 2015 and 2016 respectively in the experimental field of Department of Crop Production of ESPD of Uman NUH.

The scheme of the experiment included five variants of seeding rates of oil flax (5.0; 6.0; 7.0 (check variant); 8.0 and 9.0 million seeds per 1 ha). Replication in experiments is 3 times, the area of the sown area is 144 m^2 and the area of the registration area is 80 m^2. The soil of the field is the podzolized clay-loam loess black soil. Oil flax of Debiut variety was sown conventionally after winter wheat. Mineral fertilizers were used in the rate of $N_{45}P_{45}K_{45}$. Potassium and phosphate fertilizers were applied in autumn during the primary tillage and nitrogen fertilizers were applied in spring during the pre sowing cultivation.

Research results. Data in Table 1 show that on average the number of oil flax plants during the period of full sprouting correlated with the number of sown seeds during years of studies. Thus, at the seeding rate of 5.0 million seeds/ ha the plant density was 438 plants/ m^2 and at the seeding rate of 6.0; 7.0; 8.0 and 9.0 million seeds/ ha it increased to 546, 616, 701 and 786 plants/m^2, respectively.

The survival of agricultural crops during the growing season is largely dependent on the conditions established in cenosis. Plant density, the level of provision with fertilizer elements, weediness, quality of a predecessor, tillage system and others had a significant impact on the plant preservation.

The analysis on the preservation of oil flax plants showed that there is no significant difference between number of plants per unit area from the beginning of full germination to harvesting in variants with different seeding rates. Number of plants that were lost during the growing season for two years of vegetation is 9.9–12.2%. Though somewhat smaller was the loss at seeding rate (5.0) and 6.0 million plants/ ha. Increasing the seeding rate to 9.0 million plants/ ha determined the highest number of plants that were lost during the growing season. Although, the difference between the variants in the number of plants that were lost during the growing season was on average only 2.3% for two years.

Experimental data show (Table 2) that seeding norms influence on oil flax yields more.

Reducing the seeding rate from 7.0 to 5.0 million seeds per hectare in 2015 and in 2016 led to a significant shortage of yield which on average was 2.0 kg/ha or 12.4 % for two years. Increasing the seeding rate to 8.0 million seeds per hectare was accompanied by an insignificant decrease in the yield which in 2015 and 2016 1.0 and 0.4 kg/ha, respectively, at HIP_{05} 1.1 and 0.8 kg/ha, respectively.

Further increase in the seeding rate to 9.0 million seeds per hectare was accompanied by a significant reduction in seed yield (1.5 t/ha in 2015 and 0.8 kg/ha in 2016) compared with the check variant.

The optimum seeding rate for oil flax is the one when seeding 6.0 million similar seeds per hectare. Under such conditions flax oil has the highest productivity of crops.

It was found empirically that the oil content in seeds of oil flax was not dependent on the crop density.

The experimental data (Table 3) indicate that the oil content in oil flax seeds of Debiut variety in 2016 depending on the density was within 38.93–40.22 %. Increased density by the seeding rate from 6.0 to 7.0 million similar seeds per hectare provided increasing oil content in seeds by 0.06 %. Further increasing the seeding rate to 8.0 million led to a little decrease in oil content in seeds. A similar situation was in 2015 when the highest oil content was found in the variant with the seeding rate of 6.0 million seeds/ ha.

Flax oil is a crop that is grown for a high seed yield with high oil content and, as a result of it, its yield per unit area depends on these components.

The lowest oil yield of flax seeds was obtained at seeding of 5.0 million seeds per hectare. This is directly dependent on the obtained low yield with lower oil content in seeds. Moreover, with increasing plant density there is a tendency to increase oil content

in seeds and, therefore, increasing its yield per unit area. Comparing the seeding rates shows that on average for years of studies the smallest oil yield per unit area is at the seeding rate of 5.0 million seeds/ ha and at seeding rates of 7.0 and 6.0 million seeds/ ha the oil yield was almost at the same level. When seeding 7.0 mln seeds/ ha the yield is lower compared with the rate of 6.0 million seeds/ ha but the oil content is slightly higher and overall the oil yield is at the same level. Variants with the seeding rate of 9.0 million seeds/ ha provided slightly lower oil yield per hectare. Due to the harvest shortfall, the gross oil yield was less compared to variants with seeding rates of 7.0 and 8.0 million seeds/ ha.

Our studies on the influence of the density of oil flax sowing indicate that it is possible to change growing conditions significantly for maximum economically viable yield of flax seeds with increased oil content and yield per unit area using this agricultural measure.

Conclusions. The optimum seeding rate for oil flax is 6.0 million similar seeds per hectare. Under such conditions flax oil has the highest productivity, the highest oil yield per hectare and offers the highest economic effect.

Bibliographic list

1. Зінченко О. І. Рослинництво : підручник / О. І. Зінченко. – Умань : Сочінський М. М., 2016. – 612 с.
2. Карпець І. П. Льон / Карпець І. П., Лихочвор В. В., Проць Р. Р. – Львів, 2004. – 35 с.
3. Федоровський М. Т. Олійні культури в степу України / Федоровський М. Т. – Дніпропетровськ : Промінь, 1972. – С. 38–44.
4. Яковенко Т. М. Продуктивність льону олійного залежно від норм висіву і способу сівби в умовах Південного Степу України / Т. М. Яковенко, Ю. М. Гобеляк // Збірник наукових праць Уманського державного аграрного університету. – Умань, 2007. – Вип. 65, ч. 1 : Агрономія. – С. 203–208.
5. Довідник по олійних культурах / [Борисоннік З. Б., Михайлов В. Г., Погорлецький Б. К. та ін.]. – К. : Урожай, 1988. – С.153–167.
6. Лихочвор В.В. Рослинництво. Технології вирощування сільськогосподарських культур / Лихочвор В. В. – [2-ге вид., випр.]. – К. : Центр навч. літератури, 2004. – 808 с.
7. Шваб С.Б. Перспективи вирощування олійного льону в умовах Полісся України / С. Б. Шваб // Збірник наукових праць Уманського ДАУ. Біологічні науки і проблеми рослинництва (спеціальний випуск). – Умань, 2003. – С. 765–767.
8. Основи наукових досліджень в агрономії : підручник / за ред. В. О. Єщенка. – К. : Дія, 2005. – 288 с.

YIELDS OF ALFALFA-CEREAL AGROPHYTOCENOSES DEPENDING ON TECHNOLOGICAL METHODS OF GROWING

I. Senyk, Candidate of Agricultural Sciences, Senior Research Fellow,
N. Vorozhbyt, N. Boltyk
Ternopil Research station of the Institute of Veterinary Medicine of the National *Academy of Agrarian Sciences of Ukraine*
P. 58–62. Bibl. 8.

The problem statement. The agricultural sector of economics with its basic component such as agriculture defines limited food as well as economic, environmental and energy security. One of the implementation issues of "The State Target Program of the agricultural sector for the period till 2020" is to encourage the development of dairy and beef cattle. The revival of the livestock industry, on which state directly depends the food security of the country, is defined by the forage production efficiency. In this regard, a strategically important issue is to ensure a strong forage base especially the production of sufficient number of high-quality forage, balanced in nutrients. An important role is given to alkali forage production [7].

Basic material presentation. Grass mixture consisted of planting alfalfa, chaff cane and Bromus inermis.

The scheme of the experiment aimed studying different options for fertilizing cultivated legume-cereal agrophytocenoses.

Assessing the impact of pre-treatment of seed bean component methods of fertilization and foliar fertilizing demonstrates the high efficiency of these technological methods in forming the productivity of vegetation.

On average, in the research years (2014–2015) among experiment variations, the highest yield of dry substance is fixed in the version with the following actions – the planting of treated seed and growth alfalfa seeds, treated with growth promoters Viva and inoculant Ryzobofit, the adding of phosphorous-potash fertilizer $P_{60}K_{60}$ and the foliar feeding by Tryaminom Plus – 10,54 t/ha. The least productive was the control variant without treatment, fertilization and foliar feeding – 5,20 t/ha.

Absolute control without pre-treatment of seeds, fertilizers and foliar fertilizing provided dry substance yield at 5,20 t/ha, which was the lowest among the studied variants. Treatment of seed alfalfa with growth promoters Viva ensured yield of 5,72 t/ha, Ryzobofitom – 6,28 t/ha, and their combinations – 6,23 t/ha. The use of phosphorus-potassium fertilizer boosted performance under the stand 7,49; 8,05; 8,34; 9,17 t/ha. Foliar application of Tryaminom plus has a positive impact on the output of dry substance per hectare as for self-use, and in combination with phosphorus-potassium fertilizer.

In general, among the variations of the experiment, on average according to years of research, the highest productivity of dry substance belongs to the version of treated stimulant sowing and growth Viva inoculant Ryzobofit seed alfalfa seed, as well as the introduction of phosphorus-potassium fertilizer $P_{60}K_{60}$ and conduct foliar feeding Tryaminom Plus – 10,54 t/ha.

Conclusions. As a result of studies it was found out that in natural moisturizing forest-steppe of West it is appropriate to pretreat bean seeds stimulant component with Viva growth and bacterial drug Ryzobofit, add phosphorus-potassium fertilizer and foliar $P_{60}K_{60}$ and apply Tryamin Plus in an amount of 2 l/ha.

Bibliographic list

1. Біологічно активні речовини в рослинництві / З. М. Грицаєнко, С. П. Пономаренко, В. П. Карпенко, І. Б. Леонтюк. – К. : Нічлава, 2008. – 345 с.

2. Василенко М. Г. Агроекологічне обґрунтування застосування нових вітчизняних добрив і регуляторів росту рослин в агроекосистемах Лісостепу та Полісся України : автореф. дис.

на здобуття наук. ступеня д-ра с.-г. наук : спец. 03.00.16 «Екологія» / Василенко М. Г. – К., 2015. – 50 с.
3. Вплив мікробних препаратів на засвоєння культурними рослинами поживних речовин / В. В. Волкогон [та ін.] // Вісник аграрної науки. – 2010. – № 5. – С. 25–28.
4. Методика проведення дослідів з кормовиробництва і годівлі тварин / за ред. А. О. Бабича. – [2-ге вид., доп.]. – К. : Аграрна наука, 1998. – 80 с.
5. Петриченко В. Ф. Стратегія розвитку кормовиробництва в Україні / В. Ф. Петриченко, О. В. Корнійчук // Корми і кормовиробництво. – 2012. – Вип. 73. – С. 3–11.
6. Пономаренко С. П. Регулятори росту рослин в землеробстві / С. П. Пономаренко. – К. : Ярмарок, 2003. – 143 с.
7. Про схвалення Концепції Державної цільової програми розвитку аграрного сектору економіки на період до 2020 року [Електронний ресурс] // Єдиний веб-портал ОВВ України «Урядовий портал». – № 1437-р від 30.12.2015 р. – Режим доступу : http://www.kmu.gov.ua/control/uk/cardnpd?docid=248907971.
8. Ярмолюк М. Т. Культурні пасовища в системі кормовиробництва / Ярмолюк М. Т., Зінчук М. П., Польовий В. М. – Рівне : Волинські обереги, 2003. – 292 с.

THE EFFECTS OF MICROBIAL PREPARATION POLIMIKSOBAKTERYNU – STIMULATOR OF PLANT GROWTH ON THE PHOTOSYNTHETIC ACTIVITY OF MAIZE

L. Shevchenko
Institute of Agricultural Microbiology and Agroindustrial Manufacture NAAS, Chernihiv
P. 62–68. Bibl. 16.

Formulation of a problem. Thanks to small norms of an bringing and to a biological origin the regulators of plants body height belong to the safety preparations which are widely used in agriculture.

It needs a theoretical and practical ground of studying the regularities of forming the assimilatory area of deciduous surface and the net productivity of photosynthesis as one of important indexes the photosynthetic activity of sowing the farming cultures of application the biological preparations.

Statement of a basic material. Studying of microbial preparation's action Polimiksobakterynu on the productivity of photosynthesis in the conditions of vegetation and field experiments was conducted on a chart: 1) monitoring without bacterization and a surface treatment; 2) Polimiksobakterynu (bacterization of seeds); 3) a surface treatment of the vegetative plants in a phase of 3–5 leaflets; 4) Polimiksobakterynu (bacterization of seeds) + a surface treatment of the vegetative plants in a phase of 3–5 leaflets.

It was found that the using of Polimiksobakterynu influences for increasing the area of the assimilation surface of the plants' leaves by all variants of experience in the condition of a vegetation experience and especially at bacterization of seeds with processing of the vegetative plants that provided the largest increasing the area of the assimilation surface of the leaves for 64,4% concerning the monitoring.

It was defined that in conditions of field research the area of a deciduous surface of plants in dynamics changed in a depending on a phase of plants' development and the methods of using Polimiksobakterynu at cultivation of maize. In the beginning of blossoming plants the area of deciduous surface was from 4099,1 plant cm^2 in the control variant to 5184,4 plant cm^2 in the variant combining with the bacterization of seeds and a surface treatment of vegetative plants. The maximum difference of indexes the area of a deciduous surface was observed in a blossoming phase. The bacterization of seeds provided the growth area of a deciduous surface for 19,6% concerning the monitoring. The area of a deciduous surface combining with the bacterization of seeds and a surface treatment of the vegetative plants was increased for 28,1% in compared with the control variant. The area of leaves was decreased in all variants in the phase of lactic and wax ripeness it was bound to an atrophy of the leaves the lower tier which completely give life–giving substances reproductive part of a harvest.

It was investigated that the bacterization to with the surface treatment of vegetative plants influences to increasing of net productivity the photosynthetic as one of indexes the efficiency of photosynthetic process for 86,2%. To essential increasing of the photosynthetic potential of crops also promoted the different methods of application Polimiksobakterynu at cultivation of crops. This index was 3,52 (mil.m^2/ha)×days by the monitoring at the level 3,22 (mil.m^2/ha)×days in the variant with the bacterization of seeds. The maximum level of this index was noted in the variant of " bacterization of seeds + a surface treatment of vegetative plants " and made 3,85 (mil.m^2/ha)×days.

Conclusion. Using the microbial preparation Polimiksobakterynu – a growth factor of plants by bacterization of seeds in connection with the surface treatment of plants on the vegetation at the cultivation of maize raises the quantitative parameters of photosynthetic activity of plants that has essential important and practical value for increasing the productivity of this culture.

Bibliographic list

1. Ничипорович А. А. Фотосинтетическая деятельность растений в посевах / А. А. Ничипорович, Л. Е. Строганова, М. П. Власова. – М. : АН СССР, 1969. – 137 с.
2. Гуляев Б. И. Фотосинтез, продукционный процесс и продуктивность растений / Б. И. Гуляев, И. И. Рожко, А. Д. Рогаченко. – К. : Наук. думка, 1989. – 151 с.
3. Курдиш И. К. Гранулированные микробные препараты для растениеводства: наука и практика / И. К. Курдиш. – К. : КВІЦ, 2001. – 142 с.
4. Дятлова К. Д. Микробные препараты в растениеводстве / К. Д. Дятлова // Соросовский образовательный журнал. – 2001. – Т. 7, № 5. – С. 17–22.
5. Моргун В. В. Проблема регуляторів росту у світі та її вирішення в Україні / Моргун В. В., Яворська В. К., Драговоз І. В. // Физиология и биохимия культурных растений. – 2002. – Т. 34, № 5. – С. 371–376.
6. Деева В. П. Регуляторы роста растений: механизмы действия и использование в агротехнологиях / В. П. Деева. – Минск : Беларус. наука, 2008. – 133 с.
7. Marulanda A. Stimulation of Plant Growth and Drought Tolerance by Native Microorganisms (AM Fungi and Bacteria) from Dry Environments: Mechanisms Related to Bacterial Effectiveness / Marulanda A., Barea J.-M., Azcon R. // J. Plant Growth Regul. – 2009. – Vol. 28. – P. 115–124.
8. Мікробні препарати в сучасних аграрних технологіях (науково-практичні рекомендації) / за ред. В. В. Волкогона. – К., 2015. – 248 с.

9. СОУ 01.11–37–783:2008. НАСІННЯ КУКУРУДЗИ. Технологічний процес нанесення мікробних препаратів. Загальні вимоги: СОУ 01.11–37–783:2008. – [Чинний від 2009-07-01]. – К. : Держспоживстандарт України, 2009. – 12 с.
10. Грицаєнко З. М. Методи біологічних та агрохімічних досліджень рослин і ґрунтів / З. М. Грицаєнко, А. О. Грицаєнко, В. П. Карпенко ; [за ред. З. М. Грицаєнко]. – К. : НІЧЛАВА, 2003. – 320 с.
11. Основы научных исследований в агрономии / [В. Ф. Моисейченко, М. Ф. Трифонова, А. Х. Заверюха и др.]. – М. : Колос, 1996. – 336 с.
12. Агрохімічний аналіз : підручник / [М. М. Городній, А. П. Лісовал, А. В. Бикін та ін.] ; за ред. М. М. Городнього. – [2-ге вид.]. – К. : Арістей, 2005. – 476 с.
13. Можаев Н. И. Программирование урожаев сельскохозяйственных культур : учеб. пос. / Н. И. Можаев, Н. А. Серикпаев, Г. Ж. Стыбаев. – Астана : Фолиант, 2013. – 160 с.
14. Доспехов Б. А. Методика полевого опыта (с основами статистической обработки результатов исследований) / Б. А. Доспехов. – [5-е изд., доп. и перераб.]. – М. : Агропромиздат, 1985. – 351 с.
15. Асанішвілі Н. М. Фотосинтетична діяльність і продуктивність агрофітоценозів кукурудзи залежно від елементів технології вирощування у Північному Лісостепу / Н. М. Асанішвілі, Г. А. Сербенюк, А. А. Бондарчук // Збірник наукових праць ННЦ «Інститут землеробства НААН». – 2012. – С. 75–81.
16. Устенко Г. П. Итоги изучения сортов и гибридов кукурузы / Г. П. Устенко // Кукуруза. – Краснодар, 1964. – С. 42–64.

THE INDICES OF OIL QUALITY OF SPRING FALSE FLAX DEPENDING ON ELEMENTS OF TECHNOLOGY GROWING

A. Lykhochvor
Lviv National Agrarian University
P. 69–75. Bibl. 11.

In developing intensive elements of false flax growing technology, it was important to determine the effect of fertilizers on oil content. If false flax yield increased with increasing fertilizers rates application, then the oil content on higher backgrounds decreased a little. Thus, on the first variant (without fertilizers) the highest oil content is on the average for two years 46,7 %. But during the application of $N_{40}R_{20}K_{40}$ the oil content of seeds dropped to 46,4 %, that is it decreased by 0,3 % (table 1). On the background of $N_{60}R_{30}K_{60}$ the oil content decreased to 46,1 %. It should be noted, that the change of false flax seeds oil during the application of fertilizers at the rates of $N_{80}P_{40}K_{80}$, $N_{100}P_{50}K_{100}$ and $N_{120}P_{60}K_{120}$ was small.

Table 1

Oil content in the seeds of false flax depending on the fertilizers rates,%.

Fertilizers rates	Oil content			Deviation,%
	2015 y.	2016 y.	Average	
Without fertilizers	46,6	46,8	46,7	-
$N_{40}P_{20}K_{40}$	46,3	46,6	46,4	- 0,3

$N_{60}P_{30}K_{60}$	46,0	46,2	46,1	- 0.6
$N_{80}P_{40}K_{80}$	45,8	46,1	45,9	- 0,8
$N_{100}P_{50}K_{100}$	45,6	46,0	45,8	- 0,9
$N_{120}P_{60}K_{120}$	45,4	46,0	45,7	- 1,0
$НІР_{05}$, т/га	0,4	0,4		

So on the variant with the application of $N_{80}P_{40}K_{80}$ the oil content decreased compared with the previous variant by 0,2 %, but on the backgrounds of $N_{100}P_{50}K_{100}$ and $N_{120}P_{60}K_{120}$ it decreased only by 0,1 % compared with the previous variants. The comparison of oil content on the variant without fertilizers (46,7 %) and on the variant with the highest application of fertilizers rates (45,7 %) it shows that the oil content decreased by 1,0 %.

Intensification elements of cultivation technology also affected on the indices of quality of false flax oil. The highest content of glucosinolates was on the control, where it was 22.8 mmol/g (table 2). In the absence of weeds, on the variant with the application of herbicide Butizan 400, the content of glucosinolates decreased to 21,7 mmol/g. The application of fertilizers provides significant increase of yield capacity through the intensification of growth processes that led to the reduction of glucosinolates by 2,0 mmol/g.

Table 2

False flax oil depending on intensification elements, on the average for 2015–2016 yy.

Intensification elements technologies	Glucosinolates, мmol/g	Oil content, %
Control	22,8	42,6
Butizan 400 (metazakhlor, 400 g/l) 1,75 l/ha	21,7	43,9
Butizan 400+ Fastak k.e. (alfa- tsypermetryn,100 g/l), 0,15 l/ha	21,6	44,0
Butizan 400+ Fastak + $N_{120}P_{60}K_{120}$	19,6	43,4
Butizan 400+ Fastak + $N_{120}P_{60}K_{120}$ + Karamba к.е (metkonazol, 60 g/l), 1 l/ha	19,0	43,9
Butizan 400+ Fastak + $N_{120}P_{60}K_{120}$ + Karamba + Piktor к.е (boskalid, 200 g/l + dymoksystrobin, 200 g/l), 0,5 l/ha	18,4	44,8
Butizan 400+ Fastak + $N_{120}P_{60}K_{120}$ + Karamba + Piktor + Intermag oliyni, 2 l/ha	18,2	45,4
Butizan 400+ Fastak + $N_{120}P_{60}K_{120}$ + Karamba + Piktor + Intermag oliyni + Intermag Bor, 1 l/ha	18,0	46,2
Butizan 400+ Fastak + $N_{120}P_{60}K_{120}$ + Karamba + Piktor + Intermag oliyni + Intermag Bor + $MgSO_4$ (5 kg/ha)	17,7	47,0

The application of fungicides, microelements, sulfur and magnesium in the technology of false flax growing ensures further reduction of glucosinolates. It should be noted that on all variants the content of glucosinolates does not exceed the MCL, which is 25 mmol/g. The oil content increased with increasing level of intensification technology. If on the control the oil content was 42.6 %, then on the variant with maximum intensification it increased to 47.0 % (Table 2).

Thus, the increase of fertilizers rates application from $N_0P_0K_0$ to $N_{120}P_{60}K_{120}$ led to the reduction of false flax oil from 46,7 % to 45,7 %. Intensification of false flax cultivation technology by making crop protection and fertilizers application provides the increase the oil content in seeds by 4,4 %. The false flax oil has a valuable fatty acid composition with predominance of linolenic (52,4–53,2 %), linoleic (15,8–17,1 %) and oleic (16,9–18,7 %) acids. This composition ensures that the oil of false flax can effectively reduce cholesterol levels and has other important medicinal properties.

Bibliographic list

1. Поляков О. І. Агротехнічні і біокліматичні особливості формування урожайності і якості насіння соняшнику, сої, льону, кунжуту, рижію, молочаю в Південному Степу України : автореф. дис. на здобуття наук. ступеня доктора с.-г. наук / Поляков О. І. – Дніпропетровськ, 2011. – 38 с.
2. Григорів Я. Я. Вплив строків сівби і технологій вирощування на якість насіння ярого рижію / Я. Я. Григорів // Вісник Національного університету водного господарства та природокористування. Серія «Сільськогосподарські науки». – 2010. – Вип. № 2(50). – С. 52–57.
3. Рослинництво. Технології вирощування сільськогосподарських культур / В. В. Лихочвор, В. Ф. Петриченко, П. В. Іващук, О. В. Корнійчук. – [3-тє вид., виправл. і доповн.]. – Львів : Українські технології, 2010. – 1088 с.
4. Дрозд І. Ф. Жирнокислотний склад насіння льону олійного в умовах Західного регіону України / І. Ф. Дрозд // Бюлетень Інституту зернового господарства. – 2011. – № 40. – С. 72–76.
5. Лях В. О. Вміст та жирнокислотний склад олії рижію ярого / В. О. Лях, І. Б. Комарова // Бюлетень Інституту зернового господарства. – 2010. – № 38. – С. 137–142.
6. Демидась Г. І. Рижій посівний – олійна культура альтернативна ріпаку ярому для виробництва біодизеля / Г. І. Демидась, Г. П. Квітко, Н. Я. Гетьман // Збірник наукових праць ВНАУ. – Вінниця, 2011. – Вип. 8(48). – С. 3–8.
7. Duran K. Determination of fatty acid composition on different false flax (Camelina sativa (L.) Crantz) genotypes under Ankara ecological conditions / Katar Duran // Turkish Journal of Field Crops. – 2013. – Vol. 18(1). – P. 66–72.
8. Abramovi H. Physico-Chemical Properties, Composition and Oxidative Stability of Camelina sativa Oil. Properties of Camelina sativa Oil / Abramovi H., Abram V. // Food Technol. Biotechnol. – 2005. – Vol. 43(1). – P. 63–70.
9. Zubr J. Oil-seed crop: Camelina sativa / Zubr J. Ind. Crop. Prod. – 1997. – Vol. 6. – P. 113–119.
10. Budin J. T. Some compositional properties of camelina (Camelina sativa L. Crantz) seeds and oils / Budin J. T., Breene W. M., Putman D. H. // J. Am. Oil Chem. Soc. – 1995. – Vol. 72. – P. 309–315.
11. Янович В. П. Економічна ефективність вирощування ріпаку для виробництва біопалива / В. П. Янович, О. В. Маколкіна // Збірник наукових праць ВНАУ. – Вінниця, 2011. – № 1(48). – С. 217–221.

THE COMPOSITION OF FATTY ACIDS OF AMARANTH GRAIN GROWN UNDER THE CONDITIONS OF THE LEFT-BANK FOREST-STEPPE OF UKRAINE

N. Gutkovskaya, researcher
V.V. Dokuchaev Kharkiv National Agricultural University
P. 76–84. Bibl. 21.

Despite the fact that there are thoroughly studied oils and fats of traditional oilseeds, today a broad attention is drawn to the rare plants, whose oils can be of value for the food, cosmetic and pharmaceutical industries.

Amaranth cropper is a plant giving seeds with high content of vitamins and mineral salts; it's also distinguished by a list of valuable biologically active substances, high protein content balanced by essential amino acids, and a high content of polyunsaturated fatty acids.

The quality of agriproducts is determined by the content of organic and mineral compounds in them. Seeds of oilseed croppers are evaluated for the content of fats, and their quality depends on the ratio of saturated and unsaturated fatty acids.

Amaranth seeds is rich in a complex of polyunsaturated fatty acids (linoleic, palmitic, oleic, and linolenic), having an acids content of 77 %. About 50 % of it is the linoleic acid from which the arachidic acid is synthesized. It has to be noted that the arachidic acid is the basis for the prostaglandins synthesis in human body.

Amaranth seeds contain 6–8 % of oil which has unique properties. Amaranth oil is rich with more than 70 % mono- and polyunsaturated fatty acids: linoleic (Omega-6), oleinic (Omega-9), linolenic (Omega-3), arachidonic, palmitoleic acids, over 9 % of phospholipids, squalene (more than 8 %), about 2 % of vitamin E, phytosterols (more than 2 %), carotenoids (vitamin A precursors), vitamin D, bile acids, various macro-and microelements (potassium, ferrum, phosphorus, calcium, magnesium, copper, etc.)).

As an initial material, cultivars of amaranth were used bred at V.V. Dokuchaiev Kharkiv National University. The cultivars are adapted for cultivation in the Left-Bank forest steppe of Ukraine and introduced into the Register of Plant Cultivars of Ukraine. The cultivar Ultra (*A. hybridus*) is early maturing; its vegetative period is 90 days, and it yields a full harvest of seeds in all weather conditions. The cultivar Student (*A. hypochondrias*) is mean-term maturing, with a vegetative period of 120 days. It gave full harvests of seeds in the years of research. The research was carried out during 2014–2016. The seeds were sown four times for the SSCF-7 seeding mahine (the first time was scheduled when the soil temperature reached +12 °C, the other seeding were made every two weeks later on) in two ways: a row method with an inter-row distance of 15 cm and a wide row method with an inter-row distance of 45 cm. The fatty acid content of the seeds was determined in the laboratory of the quality of V.Ya. Yuriev Institute of Plant Cultivation.

The study of the fatty acid composition of amaranth seeds showed that the species composition is represented by saturated, mono- and polyunsaturated fatty acids. The base of saturated fatty acids (SFAs) is represented by palmitinic C16:0 - up to 21%, stearic C18:0 – 3.33-3.95%, arachidonic C20:0 – up to 0.82%, behenic C22:0 - to 0, 30% and laurine C14:0 - 0.10-0.18% acids. Mono-unsaturated fatty acids (MUFAs) are mainly represented by oleic acid C18:1 to 40%, palmitoleic C16:1 – 0.47-0.0.69%, eicosan C20:1 - up to 0.35% acids; most polyunsaturated fatty acids (PUFAs) are linoleic acid (complex ὼ-6) C18:2 – up to 49%; it also includes linolenic acid (complex ὼ-3) C18:3 to 1.05%. In the case of UFA, both cultivars did not have a significant difference in their content depending on the method of sowing. The times of sowing had an insignificant effect on the content of lauric acid C14:0 in the Ultra cultivar: its content decreased from the first to the fourth sowing time. This trend was not observed in the Student cultivar. The content of behenic acid C22:0 varied depending on the method of sowing in the first and second times in both cultivars. There was a significant difference in the content of MUFA and PUFA in amaranth according to specific features. While in the Ultra cultivar in the fatty acid composition the amount of the MUFA is prevailing, the Student cultivar MUFA and PUFA have in the same ratio. Regarding the species composition of fatty acids, the mass fraction of oleic acid (complex ὼ-9) is larger in the Student cultivar, with its contents accumulated more in the first seeding time. Methods of sowing did not have a significant impact overall. The Ultra cultivar accumulated the complex ὼ-9 24.87 % at a row seeding method and 24.40 % in the wide-row method in the first seeding time, and 24.44 % and 23.31 % respectively in the fourth seeding time. Unlike the Student cultivar, the ὼ-6 and ὼ-3 complexes accumulate more in the Ultra variety, but there was no significant difference between the times and methods of seeding. Thus, the complex ὼ-6 ranged from 48.02 % to 49.51 % depending on the time of sowing, and the complex ὼ-3 ranged from 0.96 % to 1.26 %.

Our studies have shown that the ratio of fatty acids in amaranth seeds and fatty acid composition depended on the species features of plants and cultivation conditions. For example, the Ultra cultivar seeds are a vitamin F source to a greater extent than the Student cultivation, and saturated fatty acids are accumulated in both cultivars in equal measure.

Thus, the results of studies indicate the variability of the fatty acid composition of seeds, which to a certain extent is due to the species features and conditions of cultivation. Studies have shown that amaranth grown in the Left-Bank forest steppe of Ukraine accumulates more unsaturated fatty acids than saturated ones.

Bibliographic list

1. Гамаюрова В. С. Мифы и реальность в пищевой промышленности. II. Сравнение пищевой и биологической ценности растительных масел / В. С. Гамаюрова, Л. Э. Ржечницкая // Технология и аппараты пищевых производств : Вестник Казанского технолог. ун-та. – 2011. – № 18. – С. 146–155.

2. Гопцій Т. І. Амарант: біологія, вирощування, перспективи використання, селекція / Т. І. Гопцій. – Харків, 1999. – 273 с.

3. Динаміка показників ліпідного спектру крові у хворих на АГ II стадії при застосуванні антигіпертензивної терапії в поєднанні з олією амаранту / [Є. Х. Заремба, М. С. Була, О. В. Заремба, О. В. Заремба-Федчишин] // Фітотерапія. – 2014. – № 3. – С. 43–46.
4. Изучение биохимического состава зерна амаранта (на основе сырья Вьетнама) / [Т. Х. Као, Т. М. Нгуен, Н. Т. Ле и др.] // Вестник Астраханского гос. техн. ун-та. – 2015. – № 1(59). – С. 12–18.
5. Изучение жирнокислотного состава и противораковой активности экстрактов амаранта amaranthus viridis (на основе сырья Вьетнама) / [Као Т. Х., Фам М. Х., Нгуен Т. М., Нгуен Т. Т. и др.] // Молодой ученый. – 2017. – № 4. – С. 100–103.
6. Журавель І. О. Вивчення ліпофільних сполук рослин родини Zingiberaceae / І. О. Журавель // Укр. мед. альм. – 2010. – Т. 13, № 3. – С. 87–89.
7. Застосування олії амаранту у кардіологічній практиці / [Є. Х. Заремба, О. В. Заремба-Федчишин, О. В. Заремба та ін.] // Фітотерапія. – 2010. – № 6. – С. 15–18.
8. Казначеев С. В. Использование льняного масла, обогащенного чесноком, и льняного масла с вытяжками из корнеплодов моркови в оздоровлении и реабилитации детей [Электронный ресурс]. – Режим доступа : http://diet-msk.ru/page462087 03.04.2017.
9. Какие полезные свойства содержит амарант? Амарант, или щирица (*Amaranthus*). [Электронный ресурс]. – Режим доступа : genon.ru, 19.03.2017.
10. Килименчук О. О. Вплив масла амаранту на корисну мікрофлору людини / О. О. Килимчук, Г. Й. Євдокимова // Зернові продукти і комбікорми. – 2014. – № 3(55). – С. 15–18.
11. Коренская И. М. Фармакогностическое изучение семян различных сортов амаранта печального (amaranthus hypochondriacusl.) : автореф дисс. на соискание ученой степени канд. фарм. наук / И. М. Коренская. – Пермь, 2012. – 24 с.
12. Лобода А. В. Разработка технологии и рецептуры биологически активной добавки «Сквален-лецитин» на основе семян амаранта : автореф. дисс. на соискание ученой степени канд. техн. наук / А. В. Лобода. – Краснодар, 2009. – 24 с.
13. Медведев А. Е. Амарантовое масло – очередная панацея? Нет, но попробовать стоит [Электронный ресурс]. – Режим доступа : http://www.liveinternet.ru/users/ stupeni/post 177282563/ 19.03.2017.
14. Мирошниченко Л. А. Физиолого-биохимические аспекты онтогенеза амаранта (AMARANTHUS L.) при возделывании в Центрально-Черноземном регионе : автореф. дисс. на соискание ученой степени канд. биол. наук / Л. А. Мирошниченко. – Воронеж, 2008. – 22 с.
15. Основи раціонального і лікувального харчування / П. О. Карпенко, С. М. Пересічна, І. М. Грищенко, Н. О. Мельничук ; за заг. ред. П. О. Карпенка. – К. : Київ. нац. торг.-екон. ун-т, 2011. – 504 с.
16. Панасюк Н. Б. Вплив олії амаранту на стан системи L-аргінін/NO-синтази / NO в товстій кишці при виразковому коліті / Н. Б. Панасюк, Ю. Я. Скляров // Медична і клінічна хімія. – 2011. – Т. 13, № 4. – С. 117–119.
17. Слепцов И. В. Динамика изменения жирно-кислотного состава щирицы запрокинутой, ярутки полевой и лофанта тибетского / Слепцов И. В., Хлебный У. С., Журавская А. Н. // Наука и образование. Биологические науки. – 2015. – № 4. – С. 100–104.
18. Сошникова О. В. Исследование химического состава Amaranthus Retroflexus L. / О. В. Сошникова, В. Я. Яцюк // Росс. мед.-биолог. вестник им. акад. И.П. Павлова. – 2010. – № 2. – С. 135–141.
19. Трофимцева И. А. Биохимический состав семян амарантов, выращенных в условиях Амурской области / И. А. Трофимцева, Л. Е. Иваченко // Новые и нетрадиционные растения

и перспективы их использования : VI междунар. симпозиум : матер. конф. – Пущино, 2005. – Т. III. – С. 458–460.
20. Шульга Л. Л. Жирнокислотний склад лікарських рослинних зборів / Л. Л. Шульга, І. О. Журавель, Т. С. Безценна // Біологія та фармація. – 2012. – № 2. – С. 69–73.
21. Pedersen B. The nutritive value of amaranth grain (*Amaranthus caudatus)* / Pedersen B., Bach Knudsen K. E., Eggum B. O. // Plant Foods for Human Nutrition. – 1990. – № 40. – P. 61–71.

CHAPTER 4
FRUIT AND VEGETABLE GROWING

THE BIOCHEMICAL COMPOSITION OF FRUITS OF SUMMER APPLE VARIETIES AT THE LVIV REGION

Kiselev D. PhD, group of company TB Fruit
P. 85–89. Bibl. 10.

Formulation of the problem. Apple is one of the major fruit crops Ukraine. The climate of the Lviv region meets this culture, so for that region is widely developed industrial fruit growing, which in turn leads to the creation of new fruit processing plants. The condition for the successful development of the processing industry – waste-free production. Therefore processors are looking for ways of recycling fruit products for new products.

Presenting main material. The basic material used fruits, basic common regional varieties of apples ripening at the summer period, such as Papirovka, Williams Pride, Derbalestyval, Julia, Quinty, Melba, Red Free, Yamba.

The particular importance in the processing of apples should measure dry matter content. Number of dry matter and sugars in the fruit varies due to sentence range and features pomology varieties and weather conditions of the growing season. Varieties summer ripening period are characterized by low dry matter content (10,52–14,49%) and sugars (7,63–10,11%). For production concentrated juices are the best varieties with high

in solids and sugar. This is why the best varieties distinguished Derbalestyval, Melba and Yamba.

Pleasant fruit taste due to low acidity and high sugar-acid index. These varieties include the varieties Derbalestyval and Red Free with those sugar-acid indexes of 24.49 and 30.48 respectively. Also one of the indicators of suitability varieties for the production of functional foods has vitamins C and R. This figure is due varietal characteristics.

To maintain cleaner production is necessary to measure the presence of pectin in the fruit, and it is insoluble residue protopectin. By this measure stand varieties of apple Papirovka, Julia and Yamba.

Thus, the results of biochemical composition and quality of fruit ripening apples summer period, can select varieties for different areas of use.

Conclusions.

1. The analysis of the biochemical composition of fruits of summer apples ripening period allowed selected the best varieties for the production of concentrated apple juice – Derbalestyval, Melba and Yamba.

2. To conduct cleaner production and the production of by-products in the form of commercial pectin is selected varieties – Papirovka, Julia and Yamba.

3. Highlight and recommended for planting in gardens raw Lviv region for cleaner production grade summer ripening period Yamba.

Bibliographic list

1. Биохимия растительного сырья / [В. Г. Щербаков, В. Г. Лобанов, Т. Н. Прудникова и др.]. – М. : Колос, 1999. – 276 с.
2. ГОСТ 24556-89. Продукты переработки плодов и овощей. Метод определения витамина С. – М., 2003.
3. ГОСТ 25555.0 – 82. Продукты переработки плодов и овощей. Методы определения титруемой кислотности. – М., 2001.
4. ГОСТ 28562 – 90. Продукты переработки плодов и овощей. Рефрактометрический метод определения растворимых сухих веществ. – М., 2002.
5. Донченко Л. В. Особенности процесса гидролиза протопектина из растительной ткани / Л. В. Донченко, Г. Г. Фирсов, Е. А. Красноселова // Труды КубГАУ. – Краснодар, 2006. – Вып. 1. – С. 288–297.
6. Затраты и рентабельность переработки яблочных выжимок / Г. Ф. Фоке, Р. Асмуссен, К. Фишер, Х-У. Эндресс // Пищевая промышленность. – 1992. – № 7. – С. 27–31.
7. Колесное А. Ю. Методы оценки и качества сухих яблочных выжимок / А. Ю. Колесное // Пищевая промышленность. – 1992. – № 10. – С. 17–19.
8. Кочеткова А. А. Научно-техническое сотрудничество в области производства и использования пектина / А. А. Кочеткова, А. Ю. Колесное // Пищевая промышленность. – 1992. – № 6. – С. 37–40.
9. Причко Т. Г. Формирование качественных показытелей плодов яблони в зависимости от погодных условий периода вегетации / Т. Г. Причко, Л. Д. Чалая // Плодоводство и виноградарство Юга России. – 2011. – № 5. – С. 44–49.
10. Румянцева Г. Н. Экстракция пектина из тыквенного жома с помощью отечественных ферментных препаратов / Г. Н. Румянцева, О. А. Маркина, Н. М. Птичкина // Хранение и переработка сельскохозяйственного сырья. – М. : Пищевая промышленность, 2002. – № 6. – С. 35–39.

PRESERVATION OF ASCORBIC ACID IN STRAWBERRY JAM

I. Rozhko, Candidate of Agricultural Sciences
Lviv National Agrarian University
P. 89–92. Bibl. 8.

Formulation of the problem. Garden strawberry is one of the most popular fruit crops in Ukraine, due to the unique adaptive ability of the crop, the diversity of its agronomic characters, high productivity, versatility of fruit utilization, dietary and curative qualities of both fresh and processed fruits.

There is a clear technological classification of garden strawberry varieties: table, technical, versatile varieties, each of them has a certain set of required qualities. Jam is a widespread product of strawberry processing but at the same time its manufacturing technology is the most difficult one.

The method of perishable food processing affects significantly the quality and quantity of ascorbic acid in the finished product. It is a well-known fact that atmospheric oxygen and heat treatment reduce the content of vitamin C, which belongs to the important anti-radiation substances (countreaction vitamins) along with vitamin P (bioflavonoids), B_9 (folic acid), provitamin of vitamin A (carotene). Their physiological role is enormous. If radioactive substances destroy blood vessels, the joint interaction of vitamins C and P on the contrary, restores their elasticity and permeability. Ascorbic acid is involved in many biochemical redox processes in the body, it has anti-oxidant action and promotes tissue regeneration and wound healing, supports the body's resistance to various types of stress, and provides normal immunological and hematological status.

Task statement. Since jam is available at home, the objective of the study was to evaluate "the nutritional status" of strawberry jam in terms of getting not only aesthetic taste pleasure but also biochemical benefits of human intake of sufficient amount of one of the most important essential micronutrients – ascorbic acid.

Presenting the main material. The study was conducted in the years 2014–2015 in the laboratories of the department of horticulture in Lviv National Agrarian University. The quality of raw materials and the finished product was determined by the organoleptic and physico-chemical parameters according to current standards. The degustation of fresh fruits (in the stage of consumer ripeness) and processed products (after 6-month proofing) was conducted in the laboratory using closed method.

Based on the results of degustation and biochemical evaluation of fresh fruit, in order to study the preservation of ascorbic acid in strawberry jam, the four varieties of garden strawberry were selected, namely: Pocahontas (k), Thuriga, Istochnik, and Rubinovyi Kulon for experimental fruit processing using sugar preserving method. Jam was made on classic recipes.

Before the experimental processing, the fruits of all the varieties were evaluated by the following criteria: weight and one-dimensionality of the fruit, color intensity, pulp consistency, ease of stalk separation from the fruit.

The fruits of all four varieties met the main requirements: the average weight of the fruit – at least 5 g; form – correct, without pronounced ribbing; color – intense red; consistency – robust and medium-robust pulp; easy or medium separation of the cup and stalk from the fruit.

Due to the jam degustation results, the highest total assessment of fitness for production was given to such fruit varieties as Thuriga – 4.5 points and Rubinovyi kulon – 4.8 points.

The results of quantitative determination of the content of ascorbic acid separately in liquid (syrup) and solid (fruits) fractions showed that the solid fraction of processed product contains higher level of ascorbic acid.

The highest content of ascorbic acid both in liquid and solid fractions was revealed in the jam made of the fruit variety Istochnik – 23.3 and 24.5 mg/100 g, respectively, the lowest level was found in the jam made of the fruit variety Rubinovyi kulon – 20.0 and 22.6 mg/100 g, respectively.

The highest average content of ascorbic acid was found in jam made of the fruit variety Istochnik – 23.9 mg/100 g, the lowest level was in the jam made of the fruit variety Rubinovyi kulon – 21.3 mg/100 g

It should be noted that the highest content of ascorbic acid in raw materials (the fruit variety Istochnik – 86.4 mg/100 g) does not guarantee a high percentage of its preservation in the finished product – 27.7, which is the lowest among the variants under study. In fact, the raw material with the lowest content of ascorbic acid (the fruit variety Thuriga – 70,7 mg/100 g) provided jam with the highest percentage of its preservation, namely – 32.1.

Conclusion. The study results indicate that, if to keep all the requirements of timely harvesting, transportation, short-term storage, preparation and direct manufacturing technology of strawberry jam, it is quite possible to achieve the preservation of ascorbic acid in the range of 27.7 to 32.1 % or, on average, to 29.2 % of its content in raw materials.

Bibliographic list

1. Боднар В. М. Нові сорти суниці для переробки / В. М. Боднар // Сад. – 1995. – № 9. – С. 14–15.
2. Гуменюк О. Л. Харчова хімія : тексти лекцій / О. Л. Гуменюк. – Чернігів : ЧДТУ, 2013. – С. 156–160.
3. Жбанова Е. В. Потенциал генофонда ягодных культур в связи с селекцией на улучшение химического состава плодов : автореф. дисс. на соискание учёной степени доктора сельскохозяйственных наук : спец. 06.01.05 «Селекция и семеноводство сельскохозяйственных растений» / Е. В. Жбанова. – Мичуринск-наукоград РФ, 2013. – 52 с.
4. Рибак Г. М. Довідник по переробці плодів, ягід і винограду / Г. М. Рибак, О. М. Литовченко. – К. : Урожай, 1990. – С. 89–90.
5. Рожко І. С. Біохімічна цінність консервованої суниці / І. С. Рожко // Сільський господар. – 1999. – № 7–8. – С. 45.
6. Скалецька Л. Ф. Біологічна цінність та екологічна чистота консервованої суниці / Л. Ф. Скалецька, Г. В. Соломахіна // Сад. – 1995. – № 10–12. – С. 22–23.
7. Скалецька Л. Ф. Технологія зберігання і переробки сільськогосподарської продукції : навч. посіб. / Л. Ф. Скалецька, А. Я. Маньківський. – Ніжин, 1999. – 384 с.

8. Широков З. П. Технология хранения и переработки плодов й овощей с основами стандартизации : учеб. пос. / З. П. Широков. – М. : Агропромиздат, 1988. – С. 247–250.

THE IRON CONTENT IN EARLY BEAM PRODUCTS OF BEET

S. Stefaniuk
Lviv National Agrarian University
P. 92–95. Bibl. 5.

Formulation of the problem. The beet is consumed throughout the year, in both views – processed and fresh. In the phase of beam maturity of beet consume whole plant (as root and rosette of leaves). As is known in the spring in a human reduced immunity due to lack of vitamins, this problem can be solved by the use of beam products that was grown in open ground.

The beet has extremely important for the human body the biologically active substances. It is rich in sugars (fructose, glucose, sucrose), organic acids (citric, oxalic, malic), pectin, protein, and betaine. It has a high content of iron, copper, potassium, magnesium and vanadium, boron, iodine, manganese, molybdenum, cobalt, lithium, rubidium, fluorine, zinc. The beetroot contains vitamins, ascorbic acid, thiamin, carotene, vitamin E. The consumption of the beetroot crops (in the form of juice, salads) daily and in relatively large quantities of it enters the body a significant amount of essential vitamins. For greater efficiency beet juice drink 50 ml three times daily before meals with juice of radish, carrot, blackcurrant, apricot.

Presenting main material. The study was conducted at the experimental fields of Department horticultural of Lviv National Agricultural University in dark gray-ashed soils during 2011–2015 years. Availability of soil nutrients was average.

In experiments studied two varieties of table beet: Bordo kharkivskyj and Diy. For receiving early beam production of beet, seeds were sown at two timing: in November-December (depending on temperature and precipitation conditions) to the freezing of the soil and early in the spring as soon as possible to start spring field work.

Seeds were sown wide-method. Areas of during winter sowing were covered after complete melting of snow and thawing and drying of the soil: agrofibre and plastic wrap and early spring crops - immediately after seeding.

As seen from the results, the value of the iron content in the beam output changes all the parameters that we studied. Thus, the iron content affects sort. In Kharkov Bordeaux in the leaves for before winter sowing under cover of agrofibre the iron content in an average year study was 31.52 mg/kg, and in a sort Diy – at 6.11 mg/kg more. However, under cover with plastic wrap these values are somewhat higher, respectively, 0.62 mg/kg and 2.44 mg/kg compared to agrofibre. It should be noted that the iron content in the roots versus leaves a little less like covering between types of covering and varieties. Thus, under cover agrofibre in Bordo kharkivskyj in roots the iron content in 1.65 times, and in sort Diy in 2.1 times less than in the outlet leaves.

However, the roots of Bordo kharkivskyj under the plastic wrap piled on 2.14 mg/kg, and in sort Diy on 4.48 mg/kg more than under agrofibre. Comparing the ratio of iron content between leaves and roots, in the Bordo kharkivskyj it was in 1.52 times and in Diy in 1.79 times more.

For early spring sowing beet the iron content in all options of experiments was something less than in before winter sowing. So in Bordo kharkivskyj under agrofibre covering in the leaves the iron content was at 2.90 mg/kg, and in Diy at the 7.92 mg/kg less than in before winter sowing. However, root crops that value decreased by 3.65 and 0.90 mg/kg respectively. It is necessary to note something related iron content in the leaves to the roots in Bordo kharkivskyj – 1.86, and in Diy – 1.74.

Conclusions. The research found that the beam beet products are rich on iron. The content of it in young leaves in 1,52–2,10 times higher than in the roots, which varies depending on the variety, sowing period and type of covering. In the early beam beet production before winter sowing the iron content is much higher compared to early spring sowing.

Bibliographic list

1. Стефанюк С. В. Вирощування буряків столових на пучкову продукцію / С. В. Стефанюк // Вісник Львівського національного аграрного університету : агрономія. – 2012. – № 16. – С. 298–301.
2. Вміст металів у грунті при вирощуванні буряків столових / Г. С. Стефанюк, О. Ю. Залецька, С. В. Стефанюк, А. М. Колодій // Проблеми екологічної безпеки та якість середовища : тези Міжнар. наук.-практ. конф., 17-18 груд. 2010 р. – Львів : Львів. держ. ун-т безпеки життєдіяльності, 2010. – С. 118–120.
3. Свекольный сок – источник антиоксидантов / [А. А. Лапин, А. Е. Арбузова, Ю. А. Быковский и др.] // Картофель и овощи. – 2007. – № 6. – С. 27.
4. Сыч З. Д. Подзимние и зимние посевы – дополнительный путь получения ранних овощей / З. Д. Сыч // Овощеводство. – 2007. – № 11. – С. 26–30.
5. Сыч З. Использование агроволокна для укрывной культуры в овощеводстве / З. Сыч // Овощеводство. – 2008. – № 8. – С. 38–44.

INFLUENCE OF IRRIGATION MODE AND MOUNDING SUBSTRATE ON THE ROOT COLLAR DIAMETER OF CLONAL ROOTSTOCKS OF APPLE TREE AND YIELD OF STANDARD TRANSPLANTED PLANTS

N. Prokopenko
Uman National University of Horticulture
P. 95–101. Bibl. 8.

The results of the research of wetting depth influence under different substrates on the diameter of the root collar of clonal rootstocks of apple trees and the number of standard diameter transplanted plants in terms of Right-Bank Forest-Steppe of Ukraine are given in the article. Experimental work was done on the breeding plantations of Uman National University of Horticulture at the experimental field of problematic research laboratory of fruit seedlings. During 2008–2010 we studied the impact of irrigation with

soil wetting to a depth of 20 cm and 40 cm using saw dust and as a mounding substrate and soil on the diameter of the root collar of the breeding plantation of clonal seeding stocks of apple tree M9RN29. The way of breeding plantation running is as such: in horizontal transplantations using the 1,40×0,33 m planting system. Soil of the research area is podsolized heavy loam black soil of grain size distribution. The climate is moderately continental. According to the amount of precipitations, the area belongs to the unstable moisture zone. The dynamics of soil moisture was determined according to thermostat-gravimetric method. Samples were taken to a depth of 1.0 m.

The research of irrigation influence under different mounding substrates on the analyzed index was performed according to conventional methods. The research options included: mounding of breeding bushes with sawdust or soil at optimum humidity in the layer 0–20 and 0–40 cm. Preirrigation humidity level was 80% NV. Agricultural technology accounting and control was carried out in accordance with conventional methods. Research data processing was performed with the help of disperse analyses and computers.

By mounding with maximum soil the analyzed index in 2008 was on the areas with wetting depth of 20 cm, which is considerably more than on those without irrigation and with wetting depth of 40 cm (respectively, on 1.6 and 0.8 mm at HIP_{05} = 0,4). Significant increase in diameter of transplanted plants by mounding with soil towards unirrigated areas was noticed by with mounding bushes with sawdust and wetting depth of 20 cm. In 2010 by mounding of transplanted plants with soil without irrigation, their diameter was smaller by 2.2 mm compared to soil wetting depth of 40 cm and by 2.6 mm - to soil wetting depth of 20 cm.

It was determined that that the transplanted plants of rootstock M9had a larger diameter by using sawdust as a substrate on irrigated areas. Increase of the index largely depend on a soil wetting depth. The irrigations with soil wetting depth of 20 cm were the most effective. By such irrigation and mounding of rootstocks with sawdust the largest yield of standard transplanted plants by conventional root collar diameter was noticed.

Bibliographic list

1. Бублик М. О. Роль якості клонових підщеп при вирощуванні саджанців яблуні для інтенсивних садів / М. О. Бублик // Садівництво. – 1999. – Вип. 48. – С. 95–99.
2. Гудковский В. А. Проблемы развития российского садоводства / В. А. Гудковский // Садоводство и виноградарство. – 1998. – № 5–6. – С. 3–6.
3. Завражков А. И. Слаборослое интенсивное садоводство / А. И. Завражков // Садоводство и виноградарство. – 2001. – № 3. – С. 7–9.
4. Білик А. М. Значення підщеп у плодівництві та вимоги до них / А. М. Білик // Дім, сад, город. – 2002. – № 12. – С. 11–12.
5. Карпенчук Г. К. Учеты, наблюдения, анализы, обработка данных в опытах с плодовыми и ягодными растениями : метод. рекомендации / Г. К. Карпенчук, А. В. Мельник. – Умань : Уман. с.-х. ин-т, 1987. – 115 с.
6. Андриенко М. В. Методика изучения подвоев плодовых культур в Украинской ССР / М. В. Андриенко, И. П. Гулько – К. : УААН-УНИИС, 1990. – 104 с.
7. Єрмаков О. Ю. Типові технологічні карти вирощування садивного матеріалу плодових та ягідних культур / О. Є. Єрмаков. – К. : Інститут аграрної економіки УААН, 2002. – 70 с.
8. Доспехов Б. А. Методика полевого опыта / Б. А. Доспехов. – М. : Агропромиздат, 1985. – 351 с.

CHARACTERISTICS OF THE SPECIES DIAGNOSIS OF THE *LACTUCA SATIVA* L. PHENOTYPE BY THE MORPHOMETRIC DISTANCES OF LEAF PARAMETERS

N. Leschuk, O. Popova, E. Shkapenko
Ukrainian Institute of Plant Varieties Examination
V. Snitynskyy, O. Dydiv
Lviv National Agrarian University
P. 101–110. Bibl. 8.

Formulation of the problem. Every day, humans eat vegetative and generative organs of plants, primarily vegetable green groups, which are the source of proteins, sugars, vitamins and trace elements that have valuable therapeutic properties. The leaf is not just a vegetative organ of plants, it is a whole chemical laboratory. Slicing salad leaves, if properly cooked, are tasty and useful. The consumer rating of Lactuca sativa L. of all varieties is increasing every day by expanding the network of fast food establishments of national and international cuisine.

It is possible to achieve significant success in the marketing of marketable products of green salad plants through the introduction of European standards Euro Gap, which involves the integrated control of products in the chain from field to consumer. Particularly relevant are the requirements for the appearance of the leaves of the salad of the seed of all varieties, namely the color, consistency, shape, width, length and thickness of the leaf blade. The priority demand of consumers is the dismemberment of the leaf blade of the variety, which ensures the efficiency of the preparation of fresh salads with only one blade of a knife or the cutting of salad leaves manually with nonstandard stripes.

The modern botanical classification of the type of sown lettuce (flower formula: 2n = 18) can be represented by the following scheme: **Homeland** → Asteraceae L. → **Spesies** → Salad / Lettuce (*Lactuca*) → **Kind** → Sowing Salad (*Lactuca sativa* L.) → **Varieties:** var. *capitata*, var. *secalina*, var. a*ngstana*, var. *longifolia* The varieties differ in qualitative (QL), quantitative (QN) and pseudo-quality (PQ) phenotypic features. In the production of the most common leafy and gentamous varieties of sown salad. Sorts var. *secalina* and var. *angustana* form a socket of leaves of different shapes with rounded and pointed tops, with integral edges and dissected to the central vein. For forming heads var. *capitata* and var. *Longifolia* leaves have a fairly differentiated shape - from rounded, triangular to elongated.

In leafy and stem varieties, the leaves, stems and / or socket leaves are used for food. The condition of the stored plants is stored for 10–15 days.

Chopped salad mainly forms a half-rising leaflet socket, a head of different density is formed in the center, which is connected with the high flaccidity of plants of this variety. Leaves sit or wrinkled, round, oval or fanlike with different or toothed edges. It is formed at the expense of accelerated growth of leaves from undeveloped interstitials [1].

The roman salad forms an elevated rosette of leaves, inside of which is formed a different density elongated, conical or rounded-elongated head weighing 200–300 g [2]. It should be noted that the leaf as the basis for the formation of the productive organ of the head and the roman salad differs in length, width, area of the leaf blade, the angle of deflection of the vein, the length of the stalk (if any), the area coefficient and the form index, and this allows us to investigate and substantiate the features of the diagnostic specimen the phenotype of Lactuca sativa L. at the morphometric distances of the parameters of the limits of the manifestation of the quantitative characteristics of the leaf of various shapes.

Analysis of recent research and publications. The monitoring of the identification of varieties of sown salad and its cultivation technology for commodity and seed purposes has shown that there are a number of technological measures and improved elements of the technology of production of commodity products and seeds, mainly salad of puff and head. The lack of research results on the identification of leaflets of plants of the infrequent species (roman and oysun) is a rather topical issue, provided that the culture of the well-known varieties of salad of all varieties is introduced into the culture and the formation of a collection.

Setting objectives. Our task was to reveal the features of the species diagnosis of the *Lactuca sativa* L. phenotype according to the morphological metric characteristics, taking into account the boundary distances of the parameters of the manifestation of the quantitative characteristics of the leaf: length, width, leaf area, vein deflection angle, cut length (if present), area coefficient and form index. During research, methods are used: identification (morphological description), field, laboratory, calculating, analytical and mathematical-statistical.

Presenting main material. Field experiments on the identification of varieties of sown salad for a leaflet plate were conducted during 2012–2015 at the experimental field of the Yakimivsky variety research station in the Zaporozhye region in conditions of drip irrigation. Experiments were laid in accordance with the Methodology for the examination of varieties of salad (Lactuca sativa L.) for difference, homogeneity and stability (BOC). During the growing season, phenological observations and biometric measurements of quantitative traits were performed [3; 4].

Identification of varieties by the quantitative parameters of the leaf was carried out in the phase of the formation of the leaflet socket. For the field diagnosis of the phenotype of the salad dressing for metric distance parameters, the method of identification - the morphological description of the leaf blade was used. Investigated 20 outlets of planting salad seedlings. For an objective assessment, two thirds of the leaflet socket was to be measured and recorded. The measurements were entered into the program of variation series for search the morphometric distances of the mean and the min and max values of the variation of the sign.

Object of research - identification of quantitative characteristics of varieties of salad of sowing of all varieties in the process of formation of vegetative organs of plants in the phase of formation of leaves sockets. *The subject of the research* was sorts of sowing salad of all varieties of domestic breeding: var. *secalina* – Zorepad, var. *capitata* – Smoglyanka, var. *longifolia* – Treasure, var. *angustana* – Pogonich [5].

The varieties that were the subject of our research are common in our country and are listed in the State Register of Plant Varieties, suitable for distribution in Ukraine.

During three years of biometric observations, 1200 liters of sown salad were prepared for 300 leaves for each variety.

The varieties of sown leafy variety salad after 4 to 5 days after the formation of cotyledons formed the first true leaves, forming a socket.

Under optimal environmental conditions, the intensity of plant growth and development of salad grew significantly. All sheets are simply sessile, not cut or dissected, with or without petiole. In the form of the renal, rounded, elliptical, rectangular, lanceolate, peristorous and filiform.

The lower leaves form a socket. Var var. *secaliana* in the food uses a socket of leaves, and in the head – after the formation of the socket from 7 to 8 leaves formed a productive organ – the head that they consume. This variety combines varieties with a round, rounded-flap, short-headed form of the head.

Romance salad leaves sitting or with a wrinkled surface, round, oval or fanlike shaped with different or toothed edges, which in the center of the socket form heads of different density and color, which is a varietal sign [6]. They are formed at the expense of accelerated growth of leaves from undeveloped internodes.

The quantitative parameters of the width and length of the leaf blade within the variety of sown salad vary greatly. Its surface varies from smooth to bubbly with a thick vein in the middle. Consistency of leaves – from meat-tender, crunchy, oily to rough. The color of the leaves - from light green, green to dark red. The color of the leaf blade is represented by a range of different shades, namely: green, dark green, dark grayish-green, light green, yellowish-green, pale yellowish-green, brownish, red-brown, sometimes with red-brown pigmentation.

Measurements were made on five morphometric parameters of the leaf blade: 1 – width; 2 – length; 3 – area; 4 – geometric form; 5 is the angle between the main and the side veins in 2/3 of the leaf.

Rhyman salad forms an elevated socket of leaves, inside of which is formed a different density elongated, conical or rounded-elongated head weighing 200–300 g. The varieties of stem salad form the leaves of elongated and filiform forms.

The length, width of the leaves was determined by the method of variation statistics for a sample of 25 plants. The search for the mean value (nser) and the mean square deviation (σ) provided the setting of the boundary (min-max) of the parameter of the manifestation of the quantitative sign, where nser ± σ.

The search for the limits of the length of the inside leaf of the roman lettuce was carried out under the program "Variation series" (the t-criterion at the 5 per cent significance level for all var. Row = 2.1):

average value: a □ 19.48;

dispersion: D □ 0.42;

mean square deviation: □ □ □0.65;

medium error: □ □ m_a □ □0.15;

coefficient of variation: V □ 3.4%;

precision: $m_V = \frac{\Delta}{a} = 0.8$.

To find the code for the manifestation of the corresponding morphological trait, "Sheet internal: for length", we use the average value a = 19.48 and the mean square deviation □ □ □0.6. It was a *a* □ □ that allowed the limit margins min and max for QN to be the length characteristics of the leaf, and thus set the code for the manifestation of the corresponding sign. After all, the establishment of the code and the degree of its manifestation is mandatory during the examination for homogeneity. The algorithm of our calculations should be submitted as follows:

a min = 19,48 – 0,65 = 18,83 cm;

a max = 19,48 + 0, 65 = 20,13 cm.

The length of the typical roman lettuce interior leaf lies within the boundary limits of 18.83–20.13 cm. The quantitative parameters of the length of the inner leaves provided the limits of the variation of the trait.

The general sample for the investigated features was 60 plants of the romaine salad of the grade Skarb. For variation statistics, 25 plants were marked, whose measurable indices formed variation ranks for the corresponding signs of the outer and inner leaves. Data array – 1200 indicators.

The search for numerical values of the boundary limits of the quantitative characters of the sheet and the definition of the code of the manifestation of the sign in the corresponding sequence look like this:

leaf width: a min = 7,8 – within the range of 6.6–9.1 cm, which corresponds to the code of manifestation 7 (large). Lewis's stability ratio was *S.F= 1,4;*

leaf length: a min = 25,89 – 4,91 = 20,91 cm, a max = 25,89 + 4,91 = 30,80 cm. Numerical values of leaf length - within 20,91-30,80 cm, which corresponds to the code of manifestation 7 (large). Stability of the sign: *S.F= 1,5;*

number of leaves: a min = 27,04 – 2,11 = 24,93 pcs., a max = 27,04 + 2,11 = 29,15 pcs;

the number of leaves forming the head ranged from 24 to 29 pcs. Code of manifestation 7 (large). Symptom is relatively stable: *S.F = 1,2.*

Each attribute was evaluated as a measure of stability. Application of the Lewis stability coefficient (*S.F.*= X_{max}/X_{min}) made it possible to get different values for each sign. It should be noted that its value ≥1. Relatively stable was the manifestation of the signs "number of leaves", where the value S.F. closest to 1.

The given data show that not all the morphometric parameters of the leaves of the crop salad are observed, and the same reaction of plants to anthropogenic loading is observed. The value of the deviation of the morphometric parameters from the background varies from 4 to 40 %. At the same time, exceeding the background of the parameters of the quality of the environment, as well as the value of their coefficients of variation, is more contrasting with the morphological parameters 2–5 times.

The biometric measurements and calculations of the average leaf area according to the calculated method showed that the typical sorts of salad of all varieties shaped the unequal area of the leaf blade.

In order to determine the leaf area and the growth dynamics of the leaf surface of the seedlings salad in the Steppe zone, under the conditions of drip irrigation, it is most appropriate to use a calculation method using a conversion coefficient of 0.85, which ensures reliable accuracy and simplicity in the measurement and calculation, and also does not require additional complex devices.

The coefficient of leaf area is calculated by different methods: the method of carving – with the definition of the mass of selected sheets for analysis and the corresponding number of carving with known diameter; planimetric, or contour, – with the calculation of the area of leaves or their contours by a planimeter and calculated - the area of the leaf is calculated by its length and width and the conversion of the data obtained into the corresponding conversion coefficient, which characterizes the relationship between the leaf area and the area of the rectangle, whose sides correspond to length and width this rectangle [8].

Taking into account 3–5 percent error in measurements of the fluctuation of the transfer coefficient between the corresponding area of the leaf and the area of the formed rectangle whose sides correspond to the width and length of this leaf, will be: 0.78 (head); 0.80 (roman); 0.82 (stem) and 0.85 (leafy).

Based on a large number of measurements and calculations, it is found that the most accurate is the conversion factor of 0.85 to determine the area of the crop salad leaves, regardless of the leaf shape.

A fragment of the matrix of the results of the correlation analysis of the connections of the morphometric parameters of the leaves of the salad of the sowing of all varieties in the urboecosystem of the smt. Yakimivka of the Zaporizhzhya region shows that they are not equally connected with each other and with factors of the environment. Mostly weak and moderate correlation bonds exist, which manifest themselves at a given probability level (P = 0.95). No values of the coefficients of the area and the shape of the typical leaf blade salad of the sowing of all varieties were found within the framework of the conducted research of the bonding ties. The coefficient of the form of leaves of the salad of the stem and leaf varieties, in contrast to other morphometric coefficients of the head and Roman varieties, not only shows the slightest differences from the background values, but is also the weakest associated with the parameters of the environment – only shows a weak dependence on the hydrothermal load with the correlation coefficient 0.32 The coefficient of asymmetry forms bonds both with the coefficient of area, and with the coefficient of form. The close relationship between the shape and size of the leaves (external) is determined by the dustiness of the surface layer of air, mechanical water stress on the plant and soil contamination.

Species diagnostics of the phenotype of Lactuca sativa L. at the morphometric distances of the leaf parameters provides the prerequisites for the formation of plant productivity of all varieties, yield and quality of freshly harvested commercial products of salad, formed under the optimum conditions of influence of environmental factors of the corresponding ecologist of cultivation.

Conclusions

1. Between the values of the coefficients of the area and the shape of the typical puff pastry salad of sowing of all varieties of true connections was not found.

2. The length of the inner leaves of the roman lettuce provided the margins – 18,83–20,13 cm, which is 2,08–10,86 cm lower than the length of the outer leaves.

3. The boundary of the width of the outer leaves varied from 6.6 to 9.1 cm.

4. The fluctuations of the transfer coefficient between the corresponding leaf area and the area of the rectangle formation for varieties of all varieties of sown salad – in the range from 0.78 to 0.85.

Bibliographic list

1. Методика-класифікатор проведення експертизи сортів рослин на відмінність, однорідність і стабільність (ВОС) салату посівного (*Lactuca sativa* L.) / [Кондратенко С. І., Ткалич Ю. В., Корнієнко С. І. та ін.]. – Харків, 2015. – 54 с.

2. Лещук Н. В. Морфобіологічні та господарсько-цінні параметри типової моделі сорту салату ромен (*Lactuca sativa*: var. *Longifolia* L.) / Лещук Н. В. // Сортовивчення та охорона прав на сорти рослин. – 2013. – № 1(18). – С. 62–65.

3. Методика проведення експертизи сортів рослин групи овочевих, картоплі та грибів на відмінність, однорідність і стабільність [Електронний ресурс]. – Режим доступу : http://sops.gov.ua/pdfbooks/01.vidannia/Metodiki/vos/Ovochevi.pdf.

4. Бондаренко Г. Л. Методика дослідної справи в овочівництві і баштанництві / Г. Л. Бондаренко ; за ред. Г. Л. Бондаренка, К. І. Яковенка. – Харків, 2001. – 370 с.

5. Комплексна оцінка біологічного потенціалу сортових ресурсів (*Lactuca sativa* L.) / Н. В. Лещук, К .М. Кривицький, Н. В. Майстер, М. А. Броновицька // Сортовивчення та охорона прав на сорти рослин. – 2010. – № 2(12). – С. 63–70.

6. Leshchuk N. V. Applying analysis of variance to determine stability of morphological and value for cultivation and use characteristics of *Lactuca sativa* var. *longifolia* L. variety of lettuce ‘Skarb’ / N. V. Leshchuk // Сортовивчення та охорона прав на сорти рослин. – 2016. – № 1(30). – С. 12–16.

7. Атлас морфологічних ознак салату посівного Lactuca sativa L. / [Н. В. Лещук, О. Ю. Барабаш, В. А. Хаджиматов та ін.]. – К., 2010. – 76 с.

8. Кецкало В. В. Придатність нових сортів салату листкового до вирощування в умовах Правобережного Лісостепу / В. В. Кецкало // Збірник наукових праць Уманського державного аграрного університету – Умань : УДАУ, 2007. – Вип. 65, ч. 1. – С. 234–236.

THE INFLUENCE OF CADMIUM AND LEAD ON THE PHYTOPRODUCTIVITY OF BEETROOT BY APPLYING THE MELIORANTS AND DIFFERENT SYSTEMS OF FERTILIZERS

A. *Dydiv, assistant*
Lviv National Agrarian University
P. 110–116. Bibl. 9.

Introduction. Over recent years, anthropogenic pressure on agrocenoses has been intensifying by various pollutants, in particular heavy metals (HM), which contaminated more than 20% of Ukraine's arable land.

With the gradual growth of the concentration of heavy metal ions in the soil environment, their accumulation and redistribution in plant tissues, their inclusion in metabolic processes, which leads to morphological and biochemical changes that are

manifested in suppressing the growth and development of plants, leaves of chlorosis, necrosis of the tops and edges of leaves, dying of roots and in general reduced of phytoproductivity parameters etc.

In Ukraine, one of the most common and valuable vegetable plants with a high content of vitamins, physiologically active substances and minerals, including iron, is beetroot, which nowadays occupies about 10% (45 th ha.) in the structure of sown areas reserved for vegetable crops. It should be noted that the biological stability of beetroot against the toxic effects of heavy metals is low because the exceeded levels of 3–5 times maximum permissible concentration (MPC) of hazardous mobile forms of Cd^{2+} and Pb^{2+}, especially in acidic, poor in humus content and clay, light granulometric composition soils can reduce the crop capacity and quality of beetroots.

Therefore, today is of a great importance is the development, research and practical application in specific soil and climatic conditions of the effective and accessible, ecologically safe system fertilizing the vegetable crops, which will contribute high-speed detoxification of cultivated soil contaminated with heavy metals restoring its fertility, increasing the buffering properties of soil systems promoting obtaining the ecologically and biologically safe production of beetroot. Applications of aameliorants as antidotes, prevents migration of contaminants into adjacent environments, reducing toxicity of the processes caused by pollution.

Results and discussion. The purpose of the research is to study the effect of organic, mineral and organic-mineral systems fertilizing in combination with liming on translocation of cations in plants depending on different gradations pollution, and the impact of heavy metals on the phytoproduction parameters of beetroots.

During the three years of research in Lviv National Agrarian University studies there were conducted the researches on the effects of different fertilizer system and meliorants on the behavior of cadmium and lead in the system of «soil-plant». Salt $CdCl_2$ and $Pb(CH_3COO)_2$, were used as the pollutants that were introduced as an aqueous solution in simulated contamination levels 1; 3; 5 MPC in the gross forms separately in autumn in soil in 0-20 cm depth, and three weeks later there was applied the ameliorants $CaCO_3$ at the norm 5 t/ha (by hydrolytic soil acidity) according to the scheme of experiment.

Sowing of beetroot (variety Bordo Kharkovsky), as a test-plant was carried in second decade of May in previously contaminated of soil with heavy metals. The mineral fertilizer nitroamofos of brand 16:16:16 and the organic fertilizer Biohumus according to the scheme of experiment were applied in early spring.

The following factors were studied in the laboratory-field model experiments: Factor A – the levels of soil contamination by heavy metals (Cd and Pb); Factor B – the fertilizer system and meliorants.

The accounting area of one micro-plot is 2 m^2. The repetition of the experiment is five times and the placement of variants is systematic. The technology of growing beetroot is a common for the conditions of Western Forest Steppe of Ukraine.

The scheme of the field micro-plot two-factor experiment concerning the growing of beetroot included such variants: 1) The control variant (without fertilizer); 2) $N_{68}P_{68}K_{68}$; 3) Biohumus 4 t/ha; 4) $N_{34}P_{34}K_{34}$ + Biohumus 2 t/ha; 5) $N_{68}P_{68}K_{68}$ + $CaCO_3$ 5 t/ha; 6) Biohumus 4 t/ha + $CaCO_3$ 5 t/ha; 7) $N_{34}P_{34}K_{34}$ + Biohumus 2 t/ha + $CaCO_3$ 5 t/ha.

Conducted phonological observations of growing and development of plants. Determine the dynamics of mass growth of leaves, root crops, as well as the area of the leaf plate during the passage of phenophases. Samples of plants were taken on 10 pcs with each variant and repeat of the experiment. The following biometric indices, the surface area of the leaf blade (cut-off method), the weight of the leaves and roots (weight method) were determined. Harvesting was carried out by the local weighing and recounting per unit area.

The research has established that phytoproductivity of the beetroot in various phenophases was depended on: soil-climatic conditions of the year, the fertilizer system, meliorants and soil contamination levels by heavy metals.

According to the results of the research, with the increase in the level of soil Cd and Pb from 1 to 5 MPC, and consequently the growth of the concentration of metal ions in plants, there was a single tendency to reduce all the phytoproduction parameters of the beets, namely the area of the leaf blade, the mass leaves and roots. However, the general patterns between the variants were preserved, which had a great influence on the introduction of fertilizers and meliorants.

The smallest area of leaves of the beet was on control variant of researches, where not applying of fertilizers and ameliorants, compared with other variants of the experiment. It should be noted that the mass and area of leaves had a direct correlation with the growth of the mass of roots, which varied according to these two parameters. The maximum size of the leaf surface and the mass of leaves in all variants was the application fertilizers and meliorants in the norm $N_{34}P_{34}K_{34}$ + Biohumus 2 t/ha + $CaCO_3$ 5 t/ha.

It was noted that the beetroot had a good reaction on liming the soil, so that all processes of growing and developing the plants were better, which was reflected in a good yield and high quality of roots.

The research has established, that a greater impact on the deterioration of phytoproductivity of beet was observed by polluting the soil with lead, then cadmium. In our opinion this is due to more phytotoxicity of lead than cadmium, so the variants of lead pollution observed a smaller area of leaf plates, which affected the intensity of photosynthesis, which in turn contributed to a smaller accumulation of sugars, dry matter, vitamins in roots, and higher concentration of nitrates.

Conclusions. Experimental studies have found that, the best phytoproduction parameters of beet on contaminated soil with cadmium and lead were obtained of applying the organic-mineral fertilizer system against the background of liming the soil at $N_{34}P_{34}K_{34}$ + Biohumus 2 t/ha + 5 t/ha $CaCO_3$.

Bibliographic list

1. Балюк С. А. Хімічна меліорація ґрунтів (концепція інноваційного розвитку) / С. А. Балюк ; за ред. С. А. Балюка, Р. С. Трускавецького і Ю. Л. Цапка. – Харків : Міськдрук, 2012. – 129 с.

2. Гуральдчук Ж. З. Фітотоксичність важких металів та стійкість рослин до їх дії / Ж. З. Гуральдчук. – К. : Логос, 2006. – 208 с.

3. Методика дослідної справи в овочівництві і баштанництві. – [3-тє вид.] – Харків : Основа, 2001. – 369 с.

4. Сучасні енергоощадні технології вирощування маточних коренеплодів буряка столового / С. І. Корнієнко, Л. А. Терьохіна, О. В. Куц, В. В. Могильний // Наукові праці Інституту біоенергетичних культур і цукрових буряків. – 2014. – Вип. 21. – С. 255–259.
5. Медведев В. В. Мониторинг почв Украины: Концепции. Итоги. Задачи. / В. В. Медведев ; Нац. науч. центр «Ин-т почвоведения и агрохимии им. А. Н. Соколовського». – Харьков : Городская типография, 2012. – 536 с.
6. Овчаренко М. М. Тяжелые металлы в системе почва-растение-удобрение / М. М. Овчаренко. – М., 1997. – 290 с.
7. Рідей Н. М. Екологічна оцінка агробіоценозів: теорія, методика, практика / Н. М. Рідей, В. П. Строкаль, Ю.В. Рибалко. – Херсон : Олді–плюс, 2011. – 258 с.
8. Фатєєв А. І. Детоксикація важких металів у ґрунтовій системі : метод. рек. / А. І. Фатєєв, В. Л. Самохвалова. – Харків : Міськдрук, 2012. – 70 с.
9. Kabata-Pendias A. Trace Elements in Soils and Plants / Kabata-Pendias A. – Boca Raton : Crc Press, 2010. – 548 p.

YIELD AND QUALITY OF CELERY ROOT DEPENDING AT NORMS OF ORGANIC FERTILIZER «BIOACTIVE» IN CONDITIONS PRYKARPATTIA REGION OF UKRAINE

I. Dydiv
Lviv National Agrarian University
P. 116–119. Bibl. 7.

Introduction. The cultivation of environmentally safe vegetable products in specific soil-climatic conditions is relevant today, since a significant part of agrobiocenoses is contaminated with various pollutants. In such conditions, the use of organic fertilizers at growing vegetables is a major factor in increasing soil fertility and therefore increasing yields and improving the quality of vegetable products.

Among the great variety of vegetable crops – celery root is one of the most valuable spicy flavors of vegetable plants. Root of celery contains carbohydrates, proteins, organic acids, vitamins, phytoncides, essential oils. The increase in crop yield and the gross collection of this plant should be ensured due to many factors, among which the important place belongs to the fertilizer system, variety, etc.

One of the new types of organic fertilizers that can contribute to the restoration of soil fertility and the production of environmentally safe plant of products is the new highly effective ecologically safe organic fertilizer "Bioactive". According to its agrochemical properties, "Bioactive" fertilizer is a complex fertilizer containing all macro- and micro elements for plant nutrition.

The purpose of the research is to study the influence of different standards of organic fertilizer "Bioactive" on the yield and quality of celery in the conditions of the Precarpathian region of Ukraine.

Results and discussion. Scientific researches were carried out on sod-podzolic soils. The subject of research was the Dutching variety of celery Diamant.

The experimental scheme includes the following options: 1) Without fertilizers

(control); 2) "Bioactive" (2 t/ha); 3) "Bioactive" (4 t/ha); 4) "Bioactive" (6 t/ha); 5) Bioactive (8 t/ha); 6) Bioactive (10 t/ha); 7) Bioactive (12 t/ha).

Seedlings of celery root crops were grown in film greenhouses. The predecessor of celery was cabbage was whitehead.

As a result of the research, it was found that on the control variant (without fertilizers) the yield of celery root crops was 37.1 t/ha. By applying of the organic fertilizer "Bioactive" in the norm 2 t/ha contributed to an increase in yields by 3.4 tons/ha, or 9.2 % compared to control. The increase of fertilizers twice (4 t/ha) made it possible to obtain 45.3 t/ha, which is 4.8 t/ha higher than the previous variant.

Studies have shown that the highest yield of celery root crops was obtained by applying of Bioactive at norm of 10 and 12 t/ha, respectively, 56.1 and 57.7 t/ha. It was established that the highest yield of standard root of celery was obtained by applying of organic fertilizers at norm of 10 and 12 t/ha, respectively 91 and 93%.

The yield of standard celery root was the lowest (84%) on the control variant (without fertilizers). By applying organic fertilizer "Bioactive" at the norm, 8 t/ha the yield of standard celery root was 90%.

By applying organic fertilizer "Bioactive" increases the biochemical composition of celery root, compared to control variant. The high content of dry matter was obtained by applying organic fertilizers at norm 6 and 8 t/ha, respectively 17.7 and 18.4%, while on the control variant of the dry matter was 15.8%. Was marked a tendency to decrease the content of dry matter in celery root by applying of the higher norms of organic fertilizers (10 and 12 t/ha).

It was established, that the highest content of total sugar (4.3 and 4.5 %) was obtained by applying organic fertilizers at norm 8 and 10 t/ha, which is higher than the control variant (without fertilizers) by 1.4 and 1.6 %.

High content of vitamin "C" was obtained by applying organic fertilizers at norm 8 t/ha – 23.1 mg/100 g, whereas in the variant with fertilizers at norm of 6 and 10 t/ha this figure slightly decreased and was 22.3 and 22.9 mg/100 g, that is, it was almost at the same level.

By applying organic fertilizer at norm 2 t/ha, the content of vitamin C decreases to 21.1 mg/100 g, but the concentration of nitrate nitrogen increases to 195 mg/kg of crude mass. Note that the content of nitrates in celery root on all variants of the experiment by applying organic fertilizer "Bioactive" in different norms did not exceed the maximum allowable concentration.

Conclusions. In the conditions Prykarpattia region of Ukraine on sod-podzolic soils in order to obtain an environmentally safe celery root production it is recommended to apply organic fertilizer "Bioactive" at norm 10 t/ha, which will allow to significantly increase the yield and quality of celery roots.

Bibliographic list

1. Биоконверсия органических отходов в биодинамическом хозяйстве / [Н. М. Городний, И. А. Мельник, М. Ф. Повхан и др.]. – К. : Урожай, 1990. – 256 с.
2. Володарська А. Т. Вітаміни на грядці / А. Т. Володарська, М. О. Скляревський. – К. : Урожай, 1989. – С. 59–63.
3. Гнидюк В. Переробка органічних відходів тваринницьких комплексів і птахофабрик

методом біологічної ферментації в органічні добрива нового покоління «Біопроферм» / В. Гнидюк // Вісник Львівського національного аграрного університету : агрономія. – 2010. – № 14(2). – С. 306–312.
4. Дидів І. Вплив добрива нового покоління «Біопроферм» на продуктивність селери коренеплідної в умовах Західного регіону України / І. Дидів // Вісник Львівського національного аграрного університету : агрономія. – 2011. – № 15(2). – С. 148–151.
5. Коваленко Г. А. Пряно-лікарські рослини / Г. А. Коваленко // Дім, сад, город. – 2003. – № 7. – С. 38–39.
6. Півень І. О. Пряно-ароматичні та харчові рослини у вашому здоров'ї: фітодовідник / І. О. Півень, Л. В. Бензель, Т. Л. Олійник. – Львів, 2002. – 80 с.
7. Рідей Н. М. Екологічна оцінка агробіоценозів: теорія, методика, практика / Н. М. Рідей, В. П. Строкаль, Ю. В. Рибалко. – Херсон : Олді-плюс, 2011. – 258 с.

ECONOMICAL-BIOLOGICAL ESTIMATION OF HYBRIDS BRUSSELS CABBAGE IN THE CONDITIONS OF THE WESTERN FOREST STEPPE ZONE OF UKRAINE

O. Dydiv
Lviv National Agrarian University
P. 120–123. Bibl. 5.

Introduction. Cabbage Brussels was derived only in the early nineteenth century. She is widespread in many countries of Western Europe, especially in England, Belgium, the Netherlands, Germany, Denmark. Today, the production of Brussels cabbage is carried out in conditions with moderate summer temperatures and a long, warm autumn. Brussels sprouts in the structure of the crop area of occupies a small proportion among other cabbages. The reason for the lack of distribution of this valuable food in the sense of cabbage should be considered its relatively low yield, it is poorly kept fresh, but it is well suited for freezing. Brussels sprouts exceeds of white cabbage: by dry matter – in half, by protein and vitamins – in three to four times. Riboflavin in this cabbage is almost as much as it contains in milk.

The urgent requirement of time is the need for the introduction of new types of vegetable plants and approaches to the technologies of their cultivation. This is possible due to the cultivation of little widespread cultures, the range of which can be successfully implemented by Brussels sprouts.

However, the implementation of production of Brussels cabbage is slowly due to low crop yields, the imperfection of growing technology, and the absence of domestic varieties. In view of this, there was a need for the study of the economically valuable features of the varieties and hybrids of Brussels cabbage. Improving the main methods of cultivating Brussels cabbage in the conditions of the Western Forest-steppe of Ukraine is an urgent task. Its solution will allow increase production, expand the range of vegetable products and enrich the diet of man.

Results and discussion. The main objective of our research was to study the yield, quality and keeping quality of hybrids brussels cabbag the conditions of the

Western Forest-steppe of Ukraine. The research was carried out on dark gray podzolized soils and soils.

Studied of hybrids Brussels cabbage: 1) Abacus F1 (Syngenta) – control; 2) Brilliant F_1 (Nickerson-Zwaan); 3) Diablo F_1 (Bejo zaden); 4) Dolores F_1 (MoravoSeed); 5) Franklin F_1 (Bejo zaden).

Seedlings of the cassette for the age of 25 days were planted in the open ground of in April according to the scheme of 60x50 cm. Care for plants consisted of feeding, loosening the soil, weed control, diseases, pests. The predecessor is potatoes. In autumn was applied 40 t/ha of organic fertilizers under the plow plowing; in the spring, are soil cultivation applied mineral fertilizers (nitroamophos – 16–17 kg a.s.) at norm $N_{60}P_{60}K_{60}$.

Phonological observations, biometric measurements and records were performed by certified methods. An important indicator of the agro biological characteristics of the Brussels cabbage hybrids is the height of the plant, the quantity of heads on the stem, the weight of the head and yield.

Research has established, that Brussels cabbage plant height, depending on the hybrid ranged from 63 cm (Dolores F_1) to 120 cm (Brilliant F_1). On the control variant (Abakus F_1) height of plants was 76 cm. The largest quantity of heads per on one plant was formed by hybrids Diablo F_1 (98 pcs.) and Brilliant F_1 (110 pcs). A little less heads in hybrid Abakus F_1 (control) – 75 pcs. It was established that the greatest average weight of one head provided hybrids: Abakus F_1 (8,8 g), Diablo F_1 (9,2 g) Brilliant F_1 (10,4 g). The highest yield of the heads was provided by the hybrid Brilliant F_1 (24.5 t/ha), the yield increase (Abacus F_1) was 5.1 t/ha, or 26.2%. At cultivation of hybrid Diablo F_1 was marked high yield (22.6 t/ha). The smallest yield was provided by hybrids: Dolores F_1 (16.2 t/ha) and Franklin F_1 (18.6 t/ha).

Based on the analysis of the biochemical composition of heads of Brussels cabbage, it was found, that the content of dry matter, sugars (sum), vitamin C, nitrates and crude protein in each hybrid varied slightly.

Research has established, that all hybrids cabbage Brussels have high quality products, including the best quality indicators provided hybrids: Abakus F_1, Diablo F_1, Brilliant F_1, which are characterized by high dry matter content (15.1; 16.4; 17.6 %), amounts of sugars (3.9, 4.0, 4.6 %), vitamin C (131; 139.6; 145 mg/100 g), crude protein (6.5, 7.0, 7.2 %).

The content of nitrates in the studied hybrids did not exceed the maximum permissible concentration. (MPC) and ranged from 58 (Brilliant F_1) to 81 mg/kg (Franklin F_1). Such high biochemical indices of Brussels cabbage are valuable for baby food, long-term storage and rapid freezing.

Conclusions. In the conditions of the Western Forest Steppe Zone of Ukraine, high yield of Brussels cabbage with good quality products was received by the growing of hybrids foreign selection – Abacus F_1, Diablo F_1 and Brilliant F_1.

Bibliographic list

1. Дидів О. Й. Капустяні овочеві культури : курс лекцій / О. Й. Дидів. – Львів, 2008. – 100 с.

2. Жук О. Я. Продуктивність пізньостиглих сортів капусти брюссельської в умовах Лісостепу / О. Я. Жук, І. М. Срібна // Овочівництво і баштанництво. – 2004. − № 49. –

С. 268–274.
3. Методика дослідної справи в овочівництві і баштанництві / за ред. Г. Л. Бондаренка, К. І. Яковенка. – Харків : Основа, 2001. – 369 с.
4. Сич З. Д. Сортовивчення овочевих культур : навч. посіб. / З. Д. Сич, І. М. Бобось. – К. : Нілан-ЛТД, 2012. – 578 с.
5. Скалецька Л. Ф. Біохімічні зміни продукції рослинництва при її зберіганні та переробці / Л. Ф. Скалецька, Г. І. Подпрятов. – К. : Видавничий центр НАУ, 2007. – 288 с.

CHAPTER 5
PLANT BREEDING AND SEED GROWING

FORMATION OF BAKING PROPERTIES OF SPELT WHEAT GRAIN DEPENDING ON THE VARIETY AND STRAINS

H. Hospodarenko, S. Poltoretskyi, V. Liubych, N. Vorobiova, I. Ulianych
P. 124–129. Bibl. 16.

Problem statement. Scientific works not only in Ukraine but also abroad are devoted to the problem of improving the quality of wheat grain [1]. Certainly, it is necessary to have an appropriate varietal material to obtain grain with the desired quality. In addition, new varieties quickly lose their properties as reproductions because the greatest demand in the baking industry is generally grain of not below the third grade, according to the research of many scientists. Wheat varieties are also different by the fractional composition of protein that affects the baking properties [2].

Analysis of recent research and publications. Such leading scholars from near and far abroad made an important contribution to the study of the chemical composition of spelt wheat grain as: A. Piergiovanni, G. Laghetti, P. Perrino [3], G. Ranhorta [4], Lacko-Bartošová, Rédlová, Zl. Kohajdová and J. Karovičová [5].

Spelt wheat is usually characterized by high gluten content but it is vaguer and less elastic than soft wheat gluten [6-9]. The gluten content of spelt wheat grain varies considerably depending on the variety. According to A. Cegliňska [10], gluten content in spelt wheat grain varied from 10.8 to 30.6%. According to the research by A. Cegliňska [11], the figure was 51.6%. Similar results were obtained in the studies of A. Cegliňska, A. Michalska [12], Z. Kohajdová and J. Karovičová [10].

Bread made of spelt wheat flour has a high volume yield, correct shape and the color of the crumb is creamy with a pleasant taste and aroma. The crumb is characterized by the grainy and rough structure compared to soft wheat [13; 14]. Products made of spelt wheat flour are characterized by crispy crust and dense crumb [12].

Research objective. The aim of the study was to investigate baking properties of grain of different varieties and strains of spelt wheat caused by protein-proteinase and carbohydrate-amylase complex.

Research results. The research has found that the gluten content varied from 25.5 to 46.3 % depending on the variety and strain. None variety exceeded the control one in which the figure was 46.3 %. The gluten content of Zoria Ukrainy, Schwabenkorn and NSS 6/01 varieties, LPP 1221 and TV 1100 strains was very high (over 36.0 %). It was high (31.0–35.9 %) speaking about LPP 1197, P 3, NAK34/12–2 and NAK 22/12 strains. LPP 3117 strain had low gluten content (21.0–25.9 %). This figure of other varieties and strains was average (26.0–30.9 %).

It was found that the gluten content varied significantly over the years of research. High gluten content of Zoria Ukrainy and Schwabenkorn varieties, NAK 22/12 and TV 1100 strains in 2013 was caused by the formation of larger vegetative mass. In addition, these varieties have formed high gluten content over the years of research. Decreasing of the gluten content in grains of other varieties and strains varied depending on the lodging resistance and affection by brown leaf rust and Septoria spot pathogens.

It was determined that the falling number was changing from 379 to 416, depending on the variety and strain. However, alpha-amylase activity is low and the starch state is excellent. Thus, carbohydrate-amylase complex was optimal for bakery production.

Studies show that the bread average significantly varied from very low to high one. Grains of Zoria Ukrainy variety (523 cm^3) and NAK34/12 (484 cm^3) strain gave the high bread amount. The average amount of bread was of Shvedska 1 variety (454 cm^3) and LPP 3132 strain (460 cm^3). Grains of NSS 6/01 variety, LPP 3373, LPP 1197 and TV 1100 strains gave a low amount of bread (375–425 cm^3) and other strains gave a very low amount of bread.

Conclusions. Baking properties of spelt wheat grain vary considerably depending on the variety, strains and weather conditions. Grains of Zoria Ukrainy and Schwabenkorn varieties, LPP 1197, NAK 34/12–2 and TV 1100 strains are characterized by consistently high gluten content. However, the greatest amount of bread is obtained

from flour of Zoria Ukrainy and Shvedska 1 varieties, NAK 34/12–2 and LPP 3132 strains.

Bibliographic list

1. Reynolds M. P. Challenqes to international wheat improvement / Reynolds M. P., Hobbs P. R. , Braun H. J. // Aqreecultural Sciens. – 2007. – № 3. – P. 225–227.
2. Haqel I. Sulfurand baking-quality of br eadmaking wheat / Haqel I. // Sino-German workshop on Aspect sof Sulfur Nutritionof Plants. – Shienyang, 2005. – Sonderh 283. – P. 23–26.
3. Ruibal-Mendieta N. L. A comparative analysis of free, bound and total lipid content on spelt and winter wheat wholemeal / Ruibal-Mendieta N. L., Delacroix D. L., Meurens M. // J. Cereal Sci. – 2002. – № 35. – P. 337–342.
4. Baking and nutritional qualities of a spelt wheat sample / [Ranhorta G. S., Gerroth J. A., Glaser B. K. et al.] // Lebensm. Wiss. Technol. – 1995. – № 28. – P. 118–122.
5. Lacko-Bartošová M. The significanceof spelt wheat cultivated in ecological farming in the Slovak Republic / Lacko-Bartošová M., Rédlová M. // Proceeding of conference Organic farming. – Praha : ČZV, 2007. – P. 79–81.
6. Kohajdová Zl. Effect of incorporation of spelt flour on the dough properties and wheat bread quality / Kohajdová Zl., Karovičová J. // Żywność. Nauka. Technologia. Jakość. – 2007. – № 4(53). – P. 36–45.
7. Kernel, milling and baking quality of spring type spelt and einkorn wheats / [Abdel-Aal E. S. M., Hucl P., Sosulski F. W. et al.]. // J. Cereal Sci. – 1997. – № 26. – P. 363.
8. Abdel-Aal E. S. M. Optimizing the bread formulation for soft spelt wheat / Abdel-Aal E. S. M., Hucl P., Sosulski F. W. // Cereal Foods World. – 1999. – № 44. – P. 480–483.
9. Abdel-Aal E. S. M. Food uses for ancient wheats / Abdel-Aal E. S. M., Hucl P., Sosulski F. W. // Cereal Foods World. – 1998. – № 43. – P. 763–766.
10. Marconi E. Pasta from nontraditional raw materials / Marconi E., Carcea M. // Cereal Food World. – 2001. № 46. P. 522–530.
11. Ceglinska A. Technological value of a spelt and common wheat hybrid / Ceglinska A. // Electrinic J. Polish Agric. Uniersities. – 2003. – № 6(1). – P. 1–9.
12. Zielinski H. Bioactive compounds in spelt bread / Zielinski H., Ceglinska A., Michalska A. // Eur.Food Res. Technolol. – 2008. – № 226. – P. 537–544.
13. Hrska S. Dedicnost obsahu zakladnych frakci bielkovin y zrne ozimnej psenice / Hrska S. Brindza J., Fencik R. // Polnohospodarstvo. – 1987. – Vol. 32, № 12. – P. 1055–1065.
14. Tillage effects on weed communities in an organic winter wheat-sunflower-spelt cropping sequence / [Sans F. X., Berner A., Armengot L. et al.] // Weed Research. – 2011. – № 51. – P. 413–421.
15. Chaddock R. E. Exercises in statistical methods / Chaddock R. E. – Houghton, 1952. – 166 p.
16. Основи наукових досліджень в агрономії / [Єщенко В. О., Копитко П. Г., Опришко В. П., Костогриз П. В.]. – К., 2005. – 286 с.

RESULTS OF SELECT OF POTATO CLONES OBTAINED AT INTERSPECIES SOMATIC ORIGIN AND VARIABILITY THEIR SELECTION-VALUABLE FEATURES

P. Zavirukha, M. Konovaluk, M. Pavlechko, V. Naumov, O. Kovach
Lviv National Agrarian University
P. 130–142. Bibl. 25.

Introduction. Today, except classic methods of varieties creation in potato selection are using the new biotechnical methods in particular somatic hybridization. It based on fusion of isolated protoplasts together with forming of hybrid cells and hybrid plants. Somatic hybrids have recombination of plasmagenes that lead to appearance of recombinant plant forms. Reconstruction of nuclei and cytoplasm in cybrid forms can save not only heterozygous state in nuclei and genotype of original variety but give possibility to transfer of some valuable features that control out nuclear genetic materials (plasmagenes) of wild potato species. Thus somatic hybridization and cybrides as genetic constructions with nuclei from one of partners and cytoplasm from both is a new independent biotechnical method in current potato selection.

Material and methods. Ten lines of interspecies cybrid origin by variety Zarevo with wild species *S.berthaultii, S.acaule, S.cardiophyllum* have been used for research. In field conditions tubers of different lines (120-150 pcs. of each lines) have been sowed with area of plant nutrition 70×35 sm. The task of research was estimate of potato cybride lines in vivo and selects the best clones with complex of breeding-valuable features.

Results and discussions. At determining of average productivity of selecting clones in each cybride line in 2014–2016 are detected that the highest it was for line **O** (Зарево + *S. acaule*). So, 59 clones of this line had average productivity 1088 g/plant. It is higher than in worst cybrid line **К** on 336 g/plant. At our data the highest stability (the less variability on years) was productivity of clones of line **E** (Zarevo + *S. cardiophyllum*) and in average on three years it reached 813 g/plant. Thus, these research data show that from different lines *in vivo* can possibility distinct clones valuable for potato selection on high yield.

At determining of average quantity of tubers in selected clones from each cybrid lines in 2014–2016 are established that the highest it was for line **J** (Zarevo + *S. cardiophyllum*). So, 55 clones of this line formed the average quantity of tubers 11,5 pcs./plant. It was higher than worst line **К** on 1,3 pcs./plant. For line **O** (Zarevo + *S. acaule*) the average index in 59 clones was 11,3 pcs./plant. The lowest it was in cybrid line **h** (Zarevo + *S. berthaultii*) – in average 10,3 pcs./plant for 52 clones.

At determining of starch content of tuber of different potato cybrid lines that are planted *in vivo* are established the significant differences from each other both research lines and clones from cybrid line. So, in average for three years (2014–2016) are established that the highest starch content was at selected clones of lines **J** and **X** (origin of both – Zarevo + *S. cardiophyllum*), respectively 21,4 and 22,0%, or on 1,8 i 2,5 more than average starch content in clones of cybrid line **К** (Zarevo + *S. berthaultii*) – 19,5%. Thus absolute indexes of starch content show that in different potato cybrid lines from partners with high starch content is possible the selection of distinct clones. They have valuable as source material for potato selection on high starch content in tubers.

Conculusions. Somatic hybridization for potato is efficiency method of create of wide spectrum of variability on genetic level. Consequence of this variability is significant polymorphism of potato cybrid lines of interspecies origin at distinct economically valuable features and their complex. It gives the possibility of selection of perspective forms for further genetic researches and applied selecting programs.

Bibliographic list

1. Будин К. З. Генетические основы селекции картофеля / К. З. Будин. – Л. : Агропромиздат. Ленингр. отд-ние, 1986. – 192 с.
2. Гавриленко Т. А. Межродовая, межвидовая, внутривидовая гибридизация пасленовых на примере родов *Solanum* и *Lycopersicon*: генетические и биотехнологические аспекты : автореф. дисс. на соискание ученой степени доктора биол. наук / Т. А. Гавриленко – СПб., 1999. – 40 с.
3. Гавриленко Т. А. Создание новых форм растений на основе соматической гибридизации / Т. А. Гавриленко // Идентифицированный генофонд растений и селекция. – СПб., 2005. – С. 628–644.
4. Глеба Ю. Ю. Гибридизация соматических клеток и новые возможности генетического конструирования растений / Ю. Ю.Глеба // Биотехнология. – 1985. – № 2. – С. 75–78.
5. Глеба Ю. Ю. Клеточная инженерия растений / Ю. Ю. Глеба, К. М. Сытник. – К., 1984. – 157 с.
6. Глеба Ю. Ю. Слияние протопластов и генетическое конструирование высших растений / Ю. Ю. Глеба, К. М. Сытник. – К. : Наук. думка, 1982. – 103 с.
7. Євтушенко Д. П. Отримання та аналіз міжвидових соматичних цибридів картоплі : афтореф. дис. на здобуття наук. ступеня канд. біол. наук / Д. П. Євтушенко. – К., 1995. – 25 с.
8. Завірюха П. Д. Результати вивчення та відбору клонів цибридного походження для практичної селекції картоплі / П. Д. Завірюха, А. А. Кульба // Вісник ЛНАУ : агрономія. – 2013. – № 17(2). – С. 278–290.
9. Завірюха П. Д. Результати вивчення цибридних форм картоплі міжвидового походження як вихідного передселекційного матеріалу / П. Д. Завірюха, А. А. Кульба // Напрями досліджень в аграрній науці: стан та перспективи. – Вінниця, 2013. – С. 286–288.
10. Завирюха П. Д. Результаты изучения цибридных линий картофеля межвидового происхождения в полевых условиях / П. Д. Завирюха // Картофелеводство. – Минск, 2007. – Т. 12. – С. 248–263.
11. Завірюха П. Д. Формування елементів продуктивності клонами картоплі цибридного походження / П. Д. Завірюха // Вісник ЛНАУ : агрономія. – 2011. – № 15. – С. 143–154.
12. Кучко А. А. Біотехнологія в генетиці та селекції картоплі / А. А Кучко // Агроінком. – 1997. – № 10-12. – С. 30–34.
13. Кучко А. А. Разработка и применение биотехнологических методов создания исходного селекционного материала картофеля : дисс. … д-ра с.-х. наук / А. А. Кучко. – К., 1992. – 42 с.
14. Лакин Г. Ф. Биометрия : учеб. пособие для биол. спец. вузов / Г. Ф. Лакин. – [4-е изд., перераб. и доп.]. – М. : Высшая шк., 1990. –352 с.
15. Методичні рекомендації по проведенню досліджень з картоплею. – К., 1983. – 214 с.
16. Осипчук А. А. Актуальні питання селекції картоплі / А. А. Осипчук // Картоплярство. – 2004. – № 33. – С. 27–32.
17. Оценка диплоидного потомства соматических гибридов картофеля *S. pinnatisectum* + *S. tuberosum* по селекционно-ценным признакам / О. В. Маханько, А. П. Ермишин, В. А. Козлов, И. А. Шутинская // Картофелеводство. – Минск, 2009. – Вып. 16. – С. 77–87.
18. Росс Х. Селекция картофеля: Проблемы и перспективы / Х. Росс. – М. : Агропромиздат. – 1989. – 182 с.
19. Сидоров В. А. Клеточная инженерия картофеля / В. А. Сидоров, В. М. Самойлов, Ю. Ю. Глеба // Новые методы биотехнологии растений. – Пущино,1991. – С. 78–79.

20. Соматическая гибридизация пасленовых / В. А. Сидоров, Н. М. Пивень, Ю. Ю. Глеба, К. М. Сытник. – К. : Наук. думка, 1985. – 130 с.
21. Яковлева Г. А. Вовлечение межвидовых соматических гибридов *S. bulbocastanum* в селекционный процесс картофеля / Г. А. Яковлева, Т. В. Семанюк, С. Монархович // Картофелеводство : сб. научн. тр. – Минск, 2009. – Т. 16. – С. 54–64.
22. Andrushko M. Results of studying potato's cybrid forms of interspecies origin as parent plants for selection / M. Andrushko, P. Zaviruha // XIX Miedzynarodowa Konfer. Studenckich Kol Naukowych. – Wroclaw, 2014. – S. 239–240.
23. Production of somatic hybrids between frost resistant *Solanum commersonii* and *S. tuberosum* / [T. Cardi, F. D'Ambrosio, D. Consoli et al.] // Theor. Appl. Genet. 1993. – Vol. 87. – P. 193–200.
24. Thieme R. Characterization of the multiple resistance traits of somatic hybrids between *Solanum cardiophyllum Lindl.* and two commercial potato cultivars / R. Thieme, E. Rakosy-Tican // Plant Cell Report. – 2010. – Vol. 29. – P. 1187–1200.
25. Yermishin A. P. Application of somatic hybrids between dihaploids of potato *S. tuberosum* L. and wild diploid species from Mexico in breeding / A. P. Yermishin, O. V. Makhan'ko, E. V. Voronkova // J. Genetics. – 2006. – Vol. 42. – № 12. – P. 1414–1421.

INFLUENCE OF BIOLOGICAL PECULIARITIES OF THE SORT ON QUALITATIVE INDICES OF OIL FLAX IN THE PRECARPATHIAN AREA OF UKRAINE

I. Drozd, M. Shpek, O. Lupak, O. Lytvyn
P. 142–147. Bibl. 7.

Setting of the problem. The field of flax growing has decreased considerably in the west of Ukraine as well as in Ukraine on the whole lately. The absence of sale markets of fibre production of long-stalked flax is one of the reasons. That is why, taking into consideration the wide sphere of oil flax application in different fields of volk farm and the up-to-date tendence of the power of growing of oil-fat complex of Ukraine, it is important to apply growing oil flax in zone of Precarpathian Ukraine.

It is known from practice, that sorts show themselves unequally in different terms of their growing, that is why, realization of the potentional productivity of different sorts takes place in a different way. Researches show, that development of their qualitative and quantitative features changes rather strongly, when changed terms of growing plants.

The productivity of oil flax is a complex feature, which depends on the oil content in seeds and mass of 1000 seeds.

Aim of our research was to explore the influence of biological peculiarities of the sort on qualitative indices of oil flax in the Precarpathian area of Ukraine and on the display of such features as "mass of 1000 seeds" and oil content of seed of oil flax sorts of diverse eco-geographical origin.

Exploration of the main material. Field researches were conducted in 2014–2016 on the base of experimental area of Ivan Franko state pedagogical University of Drohobych (zone of Precarpathian Ukraine). Sod podzol and medium loamy soils are

soils of the field, on which researches were conducted. Humus content in ploughed layer is 2,75, reaction of soil solution is lightly sour, providing nutriments is medium.

The oil flax sorts, such as Aysberg (Ukraine), Baykal (France), Golden (Ukraine), Kivika (Ukraine), Sonyachnyy (Byelorussia), Orfey (Ukraine), Pivdenna nich (Ukraine), Tsyan (Russia), received from the laboratory of flax selection of the Institute of oil crops of NAAS were the material for conducting research. Sorts, used in research, were characterized by different height of plants, amount of bolls, form and colour of plant, different qualitative and quantitative features.

Hydrothermic conditions were different in the years of conducting research, namely in 2014–2016 according to the data of meteorological station of Drohobych.

Meteorological conditions were mainly favourable for the growth and development of oil flax.

Weather conditions in 2015 differed somehow from the average lasting many years indices in rise of air temperature and quantity of precipitation, less than norm. The temperature in July and August was respectively 2,3°C and 3,6°C higher than medium lasting many years one. Quantity of precipitation, just in May was 30,6 mm bigger than medium lasting many years index (127,6 mm against 97,0 mm).

Analysis of meteorological conditions in 2016 affirms, that they were also favourable for vegetation of oil flax.

Our researches, conducted in 2014–2016 affirm about the influence of environmental conditions on the level of display of the feature "plant height". Moist and warm weather in 2014 and 2016 contributed to considerable increase of plant height. Less amount of precipitation during the period of vegetation in 2015 influenced on the formation of height of plant stem (ground plant mass) of oil flax.

The oil flax sorts, used in researches differed also in the feature of "mass of 1000 seeds", which were influenced by weather conditions of growing to some extent. The greatest level of this feature was characteristic for sorts of Zolotystyy, Pivdenna nich, Aysberg, Tsyan, the lowest one – for sorts of Baykal, Sonyachnyy, Kivika. Terms of the year had a considerable influence on displaying present feature, the highest level of this feature was marked in 2015.

Weather conditions of Precarpathian Ukraine in 2014–2016 had a considerable influence on the oil content in seed either. The process of oil formation and storage in plants takes place in tight connection with vital activity of organism on the whole and depends on genetic peculiarities, characteristic for the present sort, ontogenesis and meteorological conditions of growing.

Hence, the results of researches affirm the considerable influence of weather conditions on oil content in the oil flax. Sort of Pivdenna nich was determined the most stable according to this feature among sorts with oil content 44–45 % in different years of growing. Relative fluctuation didn't increase 3 % in this sort.

Conclusions. Results of the research showed, that climatic conditions of Precarpathian Ukraine are totally favourable for cultivation of oil flax. Cultivation of the oil flax concerns taking into consideration of sort peculiarities and ground-climatic conditions of the region.

The analysis of general results of the research affirmed one more time, that weather conditions influence on valuable farm features, in particular, mass of 1000 seeds and oil content of oil flax.

Sort of Pivdenna nich was determined the most stable among explored sorts in different years of growing. Relative fluctuation of oil content in this sort didn't increase 3 %.

Bibliographic list

1. Гаврилюк М. М. Олійні культури в Україні : монографія / М. М. Гаврилюк, В. Н. Салатенко, А. В. Чехов ; за ред. А. В. Чехова. – К. : Основа, 2007. – 416 с.
2. Дмитриченко Т. Ф. Особливості росту і розвитку олійних та довгунцевого типів льону в ґрунтово-кліматичних умовах Поліської зони / Т. Ф. Дмитриченко // Зб. наук. пр. Інституту луб'яних культур УААН. – Глухів : ІЛК УААН, 2007. – С. 42–48.
3. Доспехов Б. А. Методика полевого опыта (с основами статистической обработки результатов исследований) / Б. А. Доспехов. – М. : Агропромиздат, 1985. – 365 с.
4. Лен масличный: селекция, семеноводство, технология возделывания и уборки / Ф. М. Галкин, В. И. Хатнянский, Н. М. Тишков. – Краснодар, 2008. – 191 с.
5. Отзывчивость льна масличного на погодно-климатические условия / С. И. Вакула, Л. В. Корень, Н. В. Анисимова, В. В. Титок // Льноводство: реалии и перспективы : сб. науч. материалов Междунар. науч.-практ. конф., Устье, 25-27 июня 2008 г. / РУП «Институт льна» ; редкол. : И. А. Голуб (гл. ред.) [и др.]. – Могилев, 2008. – С. 79–82.
6. Полякова И. А. Влияние условий выращивания на продуктивность льна масличного / И. А. Полякова, В. А.Ручка, О. В. Никитенко // НТБ ІОК УААН. – Запоріжжя, 2005. – Вип. 10. – С. 179–183.
7. Філіп'єв І. Д. Вміст олії в насінні льону олійного залежно від погодних умов та фону живлення на Півдні України / І. Д. Філіп'єв, І. О. Біднина // Зрошуване землеробство : зб. наук. пр. – Херсон : Атлант, 2008. – Вип. 50. – С. 105–109.

ADVANCES IN POTATO SELECTION UNDER EFFICIENT USE OF A GENEALOGICAL COMBINATION WITH PARTICIPATION OF KARPATSKYI VARIETY

V. Vlokh, Doctor of Agriculture (PhD), I. Dudar, Candidate of Agriculture (PhD),
O. Lytvyn, Candidate of Agriculture (PhD), M. Bomba, Candidate of Agriculture (PhD)
Lviv National Agrarian University
V. Kuzko, Candidate of Agriculture (PhD)
Lviv Regional State Center of Plant Varieties Inspection
P. 147–151. Bibl. 7.

Problem setting. Agriculture always needs researches concerning detection and examination of biological fundamentals of plants. In terms of possible obtaining of the expected results, they are based on attraction of genetic varieties by origin to the selection process. In the context, Karpatskyi variety takes as important place in the history of potato selection.

Main material. In 2014–2016, researches were carried out in Dubliany on dark grey podzolic medium loamy soil.

In the horizon of 0–20 cm, share of humus (according to Tiurin) made 2,3 %, pH of salt extract – 6, amount of absorbed bases – 276 mg-equiv. per 1 kg of soil, N (according to Cornfield) – 51,2, P (according to Chyrykov) – 92 and K (according to Maslova) – 107 mg per 1 kg of soil [6].

In numerous combinations, focused on the expected effect in crossings, such varieties as Hranola, Naroch, Poliska pink, Karpatskyi as well as Mavka, Slava, Polonyna, created on the base of the four previous ones, were used. Svaliavska variety was taken as a conventional standard. Among the selection material, nursery of the competition seed testing, 511-93 seedling demonstrated better indicators according to the economic estimation of competitive capacity. It was cultivated by a genealogical combination of Karpatskyi variety in composition of crossings of Polonyna x Hranola varieties. The average tuber yield made 41,7 t/ha, that was by 17,4 t/ha more than the conventional standard, i.e. Svaliavska variety.

511-93 seedling is medium early, table variety, with good cooking and tasty qualities (8,5 grade). Tubers are short-oval, white, with smooth jacket. Eyeholes are shallow. Pulp is creamy. The average weight of a tuber is up to 97 g. Starch content in tubers constitutes 19,0 %, that is by 5,2 % more than in Svaliavska variety. Plants are high resistant to late blight (8,5 grade) and other diseases. According to the economic estimation, the 511-93 seedling meets all requirements and thus, it is approved and passed for testing in a department of the State Center of Plant Varieties Inspection.

322-92 seedling, cultivated by combination of Mavka x Naroch varieties, got a high economic appraisal among the selection material (yield capacity, tuber quality, resistance to late blight and other diseases). In 2014–2016, the average tuber yield of the seedling made 33,7 t/fa, that was by 9,4 t/ha more than in the conventional standard, i.e. Svaliavska variety.

The 322-92 seedling is a medium early, table variety, with good cooking and tasty qualities of tubers (8,2 grade). Tubers are oval with white smooth jacket, shallow eyeholes and creamy pulp. The average weight of a tuber made 89 g, starch content in tubers – 18,3 %, that was by 4,5 % more than in the standard. Resistance to late blight made 8,7 grade. According to the pre-testing under conditions of Staryi Sambir State Variety Station (Affiliate of Lviv RSCPVI in 2015), yield capacity of the 322-92 seedling made 24 t/ha, that was by 4,5 t/ha more than the standard. Starch content in tubers constituted 18,1 %, starch yield made 43,4 hwt/ha, that was by 4,0 % and 15,9 hwt/ha more than the standard respectively. Marketability of the seedling tubers constituted 92 %. The plant resistance to macrosporosis, late blight and tasty qualities of tubers were not estimated (7 grade).

According to estimations in the years of the study, in different categories of selection process under the field conditions of the Department of Technologies in Crop Production of the Educational-scientific center of Lviv National Agrarian University and the pre-testing at Staryi Sambir State Variety Station, the 322-92 seedling (hereafter as Kniazha variety) has been passed for testing in a department of the State Center of Plant Varieties Inspection in 2017.

Conclusions. Under the broad use in the history of potato selection, Karpatskyi variety made a substantial contribution to creation of competitive varieties, taking a leading position in production. In the last years, its participation in combination of Polonyna x Hranola varieties has resulted in creation of 511-93 seedling. According to productivity indicators and tuber qualities, the seedling meets all requirements and thus, it is approved and passed for testing in a department of the State Center of Plant Varieties Inspection.

Bibliographic list

1. Влох В. Г. Вивчення генетичної природи практично корисних ознак у картоплі в природних умовах західних районів України та їх використання в створенні нових сортів / В. Г. Влох // Генетика та селекція сільськогосподарських рослин і тварин на Прикарпатті. – К. : Наук. думка, 1975. – С. 37–43.
2. Влох В. Г. Використання біологічного потенціалу у селекції картоплі / В. Г. Влох // Вчені Львівського державного аграрного університету виробництву. – Львів : ЛДАУ, 2005. – Вип. V. – С. 18–20.
3. Влох В. Г. Використання генетичних ресурсів рослин Українських Карпат в селекції картоплі / В. Г. Влох // Вісник Львівського національного аграрного університету : агрономія. – 2009. – № 13. – С. 105–109.
4. Влох В. Г. Ефективність селекції картоплі за участі в генеалогічній сукупності сорту Карпатський / В. Влох, І. Дудар, О. Литвин // Вісник Львівського національного аграрного університету : агрономія. – 2012. – № 16. – С. 120–125.
5. Влох В. Г. Історія селекції картоплі в Західному регіоні / В. Г. Влох // Вісник аграрної науки. – 2001. – Спец. вип., вересень. – С. 67–72.
6. Влох В. Г. Створення та ефективність використання в селекції національного генофонду рослин / В. Влох // Екологічні, технологічні та соціально-економічні аспекти ефективного використання матеріально-технічної бази АПК : матеріали Міжнар. наук.-практ. форуму, 17-18 вер. 2008 р. – Львів : Львів. нац. аграр. ун-т, 2008. – С. 135–138.
7. Ефективність використання ендеміків Українських Карпат у селекції картоплі / [В. Г. Влох, Р. С. Добровольський, І. Ф. Дудар та ін.] // Вісник Львівського національного аграрного університету : агрономія. – 2010. – №. 14(1). – С. 6–10.

CHAPTER 6
PLANT PROTECTION

FUNGICIDE PROTECTION OF WINTER WHEAT AGAINST FUSARIUM HEAD BLIGHT

V. Lykhochvor, Doctor of agricultural science, H. Kosylovych, Ph.D.,
Yu. Holiachuk, Ph. D., V. Borysiuk, Ph. D., T. Bahay
Lviv National Agrarian University
P. 152–157. Bibl. 8.

Problem statement. During last years one of main factors of decreasing of winter wheat yield are plant diseases. From complex of causal agents of fungal diseases in vegetation period the pathogens that can infect wheat ear are especially dangerous. Plant productivity and grain quality decrease as results of ear infections. On data of A. Kovalyshyn in grain with inner infection of *F. graminearum* the content of protein and moist gluten decrease on 17 and 19 % and content of starch and soluble sugars – on 5 and 4 %, appropriately [1].

Analyze of recent researches and publications. Fusarium head blight is the wide-spread disease of winter wheat. This disease lead to potential yield losses due to decreasing of field germination of plants, quantity of grains in ear and mass of 1000 grains. In addition Fusarium head blight lead to deterioration of baking qualities of grain and may creating the dangerous mycotoxins in grains. Of the six main dangerous for humans and animals life mycotoxins (aflatoxin B1, ochratoxin A, fumonisin, deoxynivalenol, zearalenone, T-2 toxin) four are toxins that formed by Fusarium spp. [2]. Grains infect by *Fusarium* spp. more intense at vegetation periods with warm and humid weather. Abundant rain in period of earing – maturity of grains, high temperature (>25ºC) and relative humidity (70–97%) promote the development of Fusarium spp.

The most spread fungi from Fusarium spp. that cause head blight are *F. graminearum*, *F. sporotrichiella*, *F. culmorum*, *F. avenaceum*. On researches of The V.M. Remeslo Myronivka Institute of Wheat of NAAS of Ukraine and Institute of Plant Protection of NAAS of Ukraine on the Ukraine territory are met 14 species of *Fusarium* spp. [3]. On data of S. Retman with co-authors at last years had changes in pathocomplex of causal agents of Fusarium head blight: *F. sporotrichioides* and *F. poae* are dominant species because they may to develop at dry conditions and without typical symptoms [4; 6]. The disease appears in phase of earing – grains filling as discoloration of ear scales. At wet weather depending to pathogen species appears white, pink, orange or red pads. At intensive development of disease yield losses reach 82% and decreasing of grains germination reach 70%. The grains infected by *F. graminearum* і *F. sporotrichiella* lead to poisoning of humans and animals. The sources of infection are infected plant debris and infected seeds [5; 7].

Based on many years researches of row of domestic and foreign scientists are determined main measures for limiting of development of Fusarium head blight. These measures are crop rotations, sowing in optimal terms, balanced mineral fertilization, using of resistant varieties, seed treatment by systemic fungicides before sowing, destroyed of plant debris. The main role among protect measures belongs spraying of plant by fungicides in beginning of flowering and after 14 days if it's needed [8].

Task statement. The aim of our research was to choice fungicides for winter wheat protection against Fusarium head blight. Experiment was carried on experimental field of Lviv National Agrarian University. The scheme of experiment included five variants of fungicides on six varieties: Toras, Estivus, Orcas, Tabak, Azano, Mulan (table 1). The technology of cultivation was typical for Western Forest-Steppe of Ukraine. In period of ending of tillering (BBCH 29) was applied preparation Alfa Standart, 50% c.s. in rate of 0,5 l/ha. In beginning of flowering (BBCH 61) was applied

fungicides Yutaka, 45,63 % s.e., 1,2 l/ha, Yamato, 30,3% c.s., 1,75 l/ha, Yamato, 30,3 % c.s., 1,5 l/ha. As standard was used fungicide Topsin M, 50 % c.s. in rate of 1,4 l/ha.

Results. During last years (2011–2016) main diseases of wheat ear was Fusarium head blight, Septoria glume blotch, Alternaria sooty moulds, Drechslera spot, powdery mildew and smuts (Fig. 1). Fusarium head blight and Septoria glume blotch had the most part from other detected diseases. It was 39,3 and 34,3% appropriately in average for five years.

Table 1

The scheme of fungicides applications

Toras	Estivus	Orcas	Tabak	Azano	Mulan
Yutaka, 45,63% s.e. (thiophanate-methyl, 350 g/l + tebuconazole, 100 g/l + cyflufenamid, 6,3 g/l) – 1,2 l/ha					
Yamato, 30,3% c.s. (tetraconazole, 70г/л + thiophanate-methyl, 233 g/l) – 1,75 l/ha					
Yamato, 30,3% c.s. (tetraconazole, 70г/л + thiophanate-methyl, 233 g/l) – 1,5 l/ha					
Topsin M, 50% c.s. (thiophanate-methyl, 500 g/l) – 1,4 l/ha					
Control (without fungicides)					

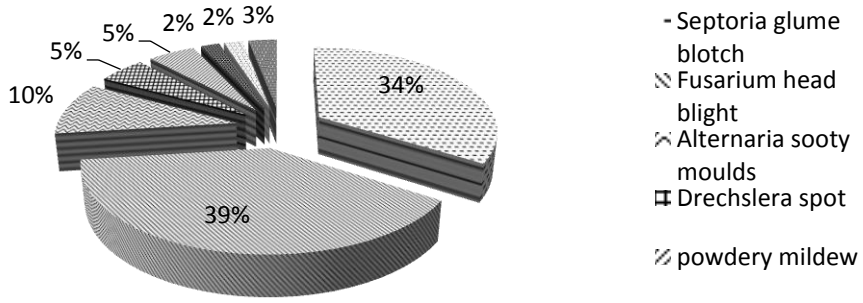

Fig. 1. Values of main ear diseases, 2011–2016 (without fungicides protection).

In tubing phase was carried out accounts of plant lesion by causal organisms. Development of such diseases as powdery mildew, Septoria leaf spot, brown and yellow rusts, Ascochyta leaf spot was observed. The least development of these mycosis was observed in variety Mulan (table 2).

Таблиця 2

Diseases development on winter wheat varieties

Variety	Degree of disease development, %				
	powdery mildew	Septoria leaf spot	brown rust	yellow rust	Ascochyta leaf spot
Toras	12,0	9,5	1,5	4,6	8,7
Estivus	8,0	10,0	3,7	5,0	10,0
Orcas	8,5	11,2	1,8	3,0	14,0
Tabak	11,7	14,8	2,0	3,5	14,5

Azano	15,0	17,5	2,5	5,2	16,0
Mulan	7,0	9,0	1,1	2,5	5,0

After application of fungicides Yutaka, 45,63% s.e. in rate of 1,2 l/ha, Yamato, 30,3% c.s., 1,75 l/ha, Yamato, 30,3% c.s., 1,5 l/ha and Topsin M, 50% c.s., 1,4 l/ha significant increasing of plant lesion by listed above diseases was not observed. Carried observations of plant lesion by Fusarium head blight detected that application of investigate preparations was effective limiting factor of development of main causal agents of disease in all varieties (table 3).

Fusarium head blight development on control was higher in all varieties. In control variant of different varieties of winter wheat indicator of disease development varied within the limits 8,2-14%. At application of investigated fungicides this indicator was not exceed 6,5%. The least development of disease was in variety Mulan (2-4%), the highest – in variety Toras (3,4-6,5%). The same tendency was observed in control variants of these varieties.

Table 3

Development of Fusarium head blight (R) and efficiency of fungicides application (E) on winter wheat

Variant	Toras		Estivus		Orcas		Tabak		Azano		Mulan	
	R, %	E, %	R, %	E, %	R, %	E, %	R, %	E, %	R, %	E, %	R, %	E, %
1	6,5	53	4,5	47	4,7	51	4,5	48	5,0	50	4,0	51
2	3,9	72	2,5	71	3,0	68	2,5	71	3,2	68	2,5	70
3	3,4	76	2,2	74	2,5	73	2,2	75	3,0	70	2,0	76
4	4,0	71	3,0	65	3,2	66	3,0	66	3,5	65	2,2	73
5	14,0	-	8,5	-	9,5	-	8,7	-	10,0	-	8,2	-

The best results of technical efficiency was obtained at application fungicide Yamato, 30,3%, c.s., in rate of 1,5 l/ha and 1,75 l/ha. The efficiency of action of this preparation depending on rate varied within the limits 70–76 and 68–72%, appropriately. Significant difference of efficiency of their action in different varieties was not detected.

Results of our researches have detected significant influence of fungicides on winter wheat yield. In control it was the least and varied within the limits 39,0–45,8 c/ha depending on varieties (table 4). At application fungicide Topsin M, 50% c.s. was significant increasing of plant productivity. Thus index of productivity in these variants was increased to 55,5–60,4 c/ha that higher on 14,6–16,5 c/ha comparatively to control. The same indicators were obtained in variant with application of fungicide Yutaka, 45,63 % s.e.

Table 4

Productivity (c/ha) of winter wheat varieties depending on applied fungicides						
Variant	Toras	Estivus	Orcas	Tabak	Azano	Mulan
1	59,8	57,0	57,2	56,1	56,7	60,4

2	65,8	63,0	63,4	62,0	62,2	68,8
3	64,0	61,2	61,5	61,1	61,0	67,3
4	58,2	56,2	56,7	55,5	55,6	60,4
5	42,4	40,2	40,8	39,0	39,3	45,8

The highest yield of winter wheat varieties was provided by application of fungicide Yamato, 30,3 % c.s. In the third variant with application of preparation in rate of 1,5 l/ha yield increased to 61,1–67,3 c/ha. At increasing of application rate to 1,75 l/ha of this fungicide in the second variant led to increasing of yield on 0,9–1,9 c/ha comparatively to rate of 1,5 l/ha.

Yield of winter wheat less depended to variety than to fungicides. The highest productivity in all variants of experiment was obtained in variety Mulan. The least yield was in varieties Tabak and Azano.

Indicators of grain quality of winter wheat varied under influence of fungicides. Mass of 1000 grains was increased from 47,8 g in the control to 52,9 g in the second variant with application of Yamato, 30,3% c.s. in rate 1,75 l/ha (table 5). The nature grain increased from 760 g to 788 g or on 28 g/l at comparative of these variants. The significant change at influence of fungicides application was occurred with two the most important indicators of grain quality – content of gluten and proteins. If in control variant the gluten content was only 23,4 %, it increase to 29,4 % or on 6,0 % at application of Yamato, 30,3 % c.s. in rate of 1,75 l/ha. In all variants with fungicides applications was occurred significant increasing of protein content at comparatively to control. The highest protein content was in variant with fungicide Yamato, 30,3 % c.s. – 13,8 %.

Table 5

Fungicides influence on grain quality of winter wheat variety Mulan

Variant	Mass of 1000 grains, g	Nature grain, g/l	Gluten content, %	Protein content, %
1	50,6	782	26,7	13,2
2	52,9	788	29,4	13,8
3	52,1	787	29,0	13,6
4	50,2	780	26,4	12,9
5	47,8	760	23,4	12,1

Conclusions. 1. Using of fungicide Yamato, 30,3 % c.s. in rate of 1,75 l/ha or 1,5 l/ha allows to limit intensive development of Fusarium head blight.

2. Application of fungicide Yamato, 30,3 % c.s. in rate of 1,75 l/ha or 1,5 l/ha in phase beginning of flowering (BBCH 61) provides increasing of yield to 61,0–68,8 c/ha depending of varieties. It is higher on 21,1–23,4 c/ha comparatively to control.

3. The highest yield (45,8–68,8 c/ha) was provided by variety Mulan.

4. Using of fungicide Yamato, 30,3 % c.s. provides increasing of gluten content in variety Mulan to 29,4 % and protein content – to 13,8 %.

Bibliographic list

1. Ковалишин А. Б. Хвороби зерна та його якість / А. Б. Ковалишин // Карантин і захист рослин. – 2011. – № 10. – С. 1–2.
2. Пріщенко О. В. Токсиногенні властивості грибів роду *Fusarium* за ураження зерна пшениці озимої / О. В. Пріщенко // Карантин і захист рослин. – 2013. – № 5. – С. 4–6.
3. Грицюк Н. В. Стійкість сортів пшениці озимої проти фузаріозної інфекції за різних строків ураження / Н. В. Грицюк // Карантин і захист рослин. – 2013. – № 10. – С. 1–3.
4. Ретьман С. В. Хвороби листя і колоса зернових колосових культур. Поширення, розвиток та заходи захисту / С. В. Ретьман, О. В. Шевчук, Н. П. Горбачова // Карантин і захист рослин. – 2011. – № 4. – С. 25–27.
5. Петриченко В.Ф. Рослинництво. Технології вирощування сільськогосподарських культур : навч. посіб. / В. Ф. Петриченко, В. В. Лихочвор. – Львів : Українські технології, 2014. – 1040 с.
6. Фунгіцидний захист рослин озимої пшениці та ячменю від «Адами» / [В. Лихочвор, Г. Косилович, Ю. Голячук, Т. Багай] // Теорія і пратика розвитку агропромислового комплексу та сільських територій : матеріали XVI Міжнар. наук.-практ. форуму, 23-25 вересня 2015 року. – Львів : Львів. нац. аграрн. ун-т, 2015. – С. 53–59.
7. Система захисту озимої пшениці від хвороб / [П. Д. Завірюха, В. В. Лихочвор, Г. О. Косилович та ін.] // Вчені Львівського національного аграрного університету виробництву : каталог інноваційних розробок. – 2015. – Вип.15. – С. 19.
8. Ефективний захист озимої пшениці від хвороб / [В. В. Лихочвор, Т. В. Данілкова, Г. О. Косилович, Ю. С. Голячук] // Зерно. – 2015. – №2. – С. 66–67.

INTEGRATED SYSTEM OF WINTER WHEAT PROTECTION AGAINST PEST ORGANISMS

H. Kosylovych, As.Prof., Ph.D., Y. Holiachuk, As.Prof., Ph.D.
Lviv National Agrarian University
P. 158–164. Bibl. 12.

Problem statement. Increasing of efficiency of cereal complex is important direction of agriculture development in country. Grain crops in Ukraine is grown on over 15 million ha of arable (50 % in cereal structure), therefore even minimal lesion of it by pests lead to huge common less of yield [1; 2; 3; 9; 10]. Today, economically significant are diseases and pests of wheat. The development of harmful organisms on plant wheat significant decreases their productivity and quality of agricultural products. The losses from pests may reach 15–35 % and for intensive development – even 50 % and more [6; 10; 11].

Analyze of recent researches and publications. Diseases, pests and weeds cause the significant losses of winter wheat yield. During last years we observed such main diseases in wheat sowing as powdery mildew, Septoria leaf spot, Drechslera leaf spot, tan spot and leaf rust. Fusarium ear rot, Septoria ear spot, Alternaria spot, powdery mildew and smuts were observed on ear. From pests of winter wheat most spread were

cereal flies that were observed in autumn and in spring in tillering phase, flea beetles and cereal leaf beetles that damaged the plant in spring tillering and tubing phase, aphids that fed the plant during all vegetation period [6].

Task statement. The main task of our research was perfecting of some elements of protection system of winter wheat against pest organisms, in particular selection of effective preparations of new generation for obtain of stable productivity and increasing of grain quality.

Results. For limiting of harmfulness of cereal ground beetle, root rots, Septoria spot, Fusarium ear rot, phytonematodes, annual and perennial weeds and other pest organisms the saturation of rotations by small grain cultures should not exceed 40–50 % and part of small grain cultures in predecessor structure of winter cultures – to 10–15 %.

For protection of sowing against diseases make seed treatment by fungicides or make sowing by incrusted seed. Effective is seed treatment by fungicides with active substances (a. s.) from group triazoles, imidazoles, carboxamides, strobilurins, phenylamides, pyridyletylamides, phenylpyroles, especially when combined active substances from different chemical groups in one preparation. It's significantly expands spectrum of preparation action on seed and soil infections. For example, triticonazole + prochloraz, pyraclostrobin + triticonazole + fluxapyroxad, prothioconazole + tebuconazole + fluopyram, fluoxastrobin + prothioconazole + tebuconazole, fludioxonil + difenoconazole + tebuconazole, fludioxonil + tebuconazole + azoxystrobin, fludioxonil + cyproconazole, tebuconazole + metalaxyl, tebuconazole + prochloraz, metalaxyl + thiram.

For protection of plant seedlings against soil pests and viruses diseases in tank mixtures to fungicide add insecticide with systemic action that has active substance from neonicotinoids group (imidacloprid, thiamethoxam, clothianidin). It is possible to use for seed treatment preparations with combination action that contain fungicide and insecticide. For increasing of resistance of plant against virus diseases and other harmful factors simultaneously seed treat by microelements.

At last years domestic and foreign researchers note that at warm, wet and durable conditions of autumn when winter wheat is in tillering phase and growth of plant is minimal, created favorable conditions for leading development of weeds. By Professor Lykhochvor V. [8] high level of weeds quantity in autumn lead to decrease of coefficient of productivity tillering. In this conditions plants form weak roots, plant enter in winter weakened, contain less sugars that increase the risk of freezing. Thus plants form smaller spike with fewer ears. Therefore is important to destroy competition of weed on beginning of the growing season that is early and the most sensitive phase of winter wheat growing. In addition application of herbicides in autumn contributes to optimal development of roots of wheat and forming of plant morphotype. It leads to maximum realization of genetic potential of productivity of modern intensive varieties. So according to Lykhochvor V. (2013) and Storchous I. (2013) [8; 12] application of winter wheat sowing by herbicides in autumn is not inferior in efficacy spring application. Moreover, many years data of this researchers confirm higher economic feasibility of autumn application of herbicides comparatively spring application.

For autumn application effective is using herbicides from group sulfonylureas. Active substances from this group may to be used separately or in mix with active substance from other chemical groups. In 1–2 leaves phase of cereal (stage BBCH 11–12) use urea derivatives + dinitroanilines (a. s. izoproturon + pendimethanil). In 3-5 leaves phase (BBCH 13–21) use sulfonylureas with metribuzin. For example, iodosulfuron + amidosulfuron + metribuzin or only sulfonylureas metsulfuron-methyl + tribenuron-methyl, metsulfuron-methyl, prosulfuron, tribenuron-methyl, tribenuron-methyl + thifensulfuron-methyl.

At last years the sowing of winter cereals infected by causal organisms of powdery mildew on early development stage more and more. So autumn applications of fungicides for prevention has advantage because saves leaves without lesions. It stimulates immunity, improve wintering of plants and decrease the probability of infection by causal organisms of other diseases, such as Septoria spot and snow mold. For autumn application to use benzofenones (a. s. metrafenone), morpholines (a. s. fenpropidin, fenpropimorph), quinazolines (a. s. proquinazid), triazoles + morpholines (a. s. propiconazole + fenpropidin), triazoles + spiroketalamines (a. s. tebuconazole + triadimenol + spiroxamine). For plant protection against leafhoppers, cereal aphids, virus diseases, cereal flies, scoops, cereal ground beetle in warm conditions is necessary spraying of sowing, especially early sowing and if didn't applied seed treatment by insecticide, one of organophosphorus preparations or synthetic pyrethroids or organophosphorus + synthetic pyrethroid + neonicotinoid or acetamides.

At period of renewal of spring vegetation for increasing of compensatory reaction of plants especially on weakened liquefied sowing that was infected by snow mold and damaged by pests is necessary to apply nitrogen fertilizer including basal way (40–60 kg/ha of nitrogen).

If herbicides not used in autumn then in spring tillering phase (BBCH 25–29) for protection sowing against weeds apply spraying by preparations depending to species and quantity of weeds. Derivatives of aryloxyalkylcarboxylic acids, in particular phenoxyacetic acid or so-called herbicides of group 2,4-D and MCPA suppress annual dicotyledonous weeds (Centaurea cyanus, Sinapis arvensis, Sisymbrium officinale, Capsella bursa-pastoris, Raphanus raphanistrum, Amaranthus spp., Thlaspi arvense) and particulary – perennial weeds (Sonchus spp., Plantago spp., Taraxacum officinale). But these preparations are not enough effective to row of such dicotyledonous weeds as Tripleurospermum inodorum, Stellaria media, Polygonum spp., Fumaria officinalis, Galium aparine, Viola arvensis and to cereal weeds. At durable using of preparations from group 2,4-D on the same fields often changes species and possible of appearance resistance to them dicotyledonous and cereal weeds. For plant protection against weeds appropriate to include herbicides with specific spectrum of action to resistant weeds to 2,4-D. Thus apply 2,4-D herbicides with other preparations, for example with sulfonylureas, derivatives of benzoic acid (a. s. dicamba) or dimethylamine salt of 2,4-D + dicamba. These tank mixtures decrease development of Tripleurospermum inodorum, Stellaria media, Polygonum spp., Fumaria officinalis, Spergula vulgaris, Galeopsis tetrahit [9; 10].

For expansion of action spectrum on dicotyledonous weeds that resistant to 2,4-D group should be used triazolpyramidine (a. s. flumetsulam, florasulam), derivatives of benzoic acid and aryloxyalkylcarboxylic acids (dicamba + dimethylamine salt of 2,4-D), derivatives of pyridine (a. s. clopyralid), sulfonylureas (a. s. prosulfuron, tribenuron-methyl, thifensulfuron-methyl, amidosulfuron, iodosulfuron, metsulfuron-methyl), derivatives of pyridinil (a. s. fluroxypyr), derivatives of thiadiazinone (a. s. bentazone). Preparations based on fluroxypyr are selective to Convolvulus arvensis, based on clopyralid – to Sonchus spp., based on bentazone – to Stellaria media, based on mixture iodosulfuron + amidosulfuron – to Galium aparine.

In researchs of Storchous I. (2013) and other researchers high efficiency against annual weeds was obtained at application tank mixtures of herbicides based on prosulfocarb with triasulfuron + dicamba, pinoxaden with sulfonylureas herbicides. Applications of preparations based on mixtures amidosulfuron + iodosulfuron-methyl sodium + antidote was effective too.

Against annual cereal weeds (Avena fatua, Agrostis spp., Echinochloa crus-galli, Setaria spp.) use herbicides, that contain against the cereal component. It is preparations based on pinoxaden + antidote and fenoxaprop-p-ethyl + antidote. Herbicides based on such active substances: pendimethalin + izoproturon, sulfosulfuron and tank mixtures of preparations based on dicamba + chlorsulfuron, izoproturon + diflufenican, iodosulfuron-methyl + mezosulfuron-methyl + diflufenican; mixtures of herbicides based on metribuzin, pinoxaden and fenoxaprop-p-ethyl, prosulfocarb with herbicides based on sulfonylureas are effective against annual and perennial cereal weeds (including Agropyron repens) and dicotyledonous weeds.

By data of our researches (Lykhochvor V., Kosylovych H., Holiachuk Y., 2015) applications of fungicides on winter wheat in ending of tillering (BBCH 29) and next in flag leaf phase (BBCH 39) and next in flowering period (BBCH 59) prevent premature aging of leaves, in particularly flag leaf stay green during long time and is saving assimilation surface. It contributes to common health of plant and to forming higher level of plant productivity.

In beginning of plant tubing phase (BBCH 31-32) for protection against diseases use fungicides with appropriate spectrum and mechanism of action. The expediency of fungicides application determine by results of phytosanitary monitoring and expected yield losses depending to level of diseases development.

For protection of winter wheat sowing against powdery mildew high-effective are derivatives of tiouredobenzoles (a. s. metrafenone, thiophanate-methyl), derivatives of triazoles (a. s. triadimenol, flutriafol, cyproconazole, propiconazole), derivatives of morpholines (a. s. tridemorph, fenpropimorph), quinazolines (a. s. proquinazid). Derivatives of triazoles (a. s. metconazole, tebuconazole, difenoconazole, propiconazole, penconazole, epoxiconazole, tetraconazole, bromoconazole), derivatives of benzimidazole (a. s. carbendazim), derivatives of imidazoles (a. s. prochloraz), derivatives of strobilurins (a. s. trifloxystrobin, azoxystrobin, pyraclostrobin), carboxamides (a. s. fluxapyroxad, penthiopyrad) have wide spectrum of action against main causal agents of small grain and may be used or separately or in combinations.

Simultaneously at application of fungicides in tank mixtures add insecticides with contact-intestinal action (against pests with biting mouthparts and feeding on the plant surface) and systemic action (against sucking pests and a hidden way of life). Against leaves-feeding pests (cereal leaf beetles, cereal aphids, larvas of cereal flies, larvas of grain sawflies, grain beetles et al.) high-effective are organophosphate preparations (a. s. fenitrothion, chlorpyrifos), synthetic pyrethroids (a. s. lambda-cyhalothrin, cypermethrin, alpha-cypermethrin, bifethrin, deltamethrin, beta-cyfluthrin), acetamides (a. s. acetamiprid). Against sucking insects (aphids, thrips, bread bugs) use organophosphate preparations (a. s. dimethoate) and neonicotinoids (a. s. imidacloprid, thiamethoxam). At high level of number of harmful species against complex of pests use combined preparations with active substances from different chemical groups and different mechanism of action. For example, synthetic pyrethroid + neonicotinoid, synthetic pyrethroid + organophosphate.

For wheat protection against Fusarium ear rot (at favorable conditions for Fusarium development: temperature – over 25°C, relative humidity of air – 80–100 %, often rains) in phase BBCH 59-61 apply fungicides with active substances metconazole, metconazole + epoxiconazole, tebuconazole + prothioconazole, tebuconazole + prochloraz. For prevention of significant yield losses against aphids (10–20 pcs. on stem), grain beetles (5–6 pcs. on 1 sq. m.), thrips (40–50 pcs. on ear), bread bugs (1–2 larvas on 1 sq. m. of strong and valuable wheat, 4–6 pcs. on 1 sq. m. – on the rest of wheat fields), cereal ground beetle (8 pcs. on 1 sq. m.) apply recommended insecticides.

For prevention of reinfection of grain by Fusarium spp., mold and bacterial diseases at storage carry out cleaning and drying of grain to 13–14 % of humidity.

Conclusions. Plant protection against pests, diseases and weeds is important aspect in plant production and difficult technological process that carry out by complex of special actions. Thus system of action of wheat protection is important part of modern technology of cultivation. It directed on prevention of mass development of pest organisms and on possibility of their quick limitation. The important is choice of effective measure and actions of plant protection and timely application of their in period when pest organisms are the most sensitive to pesticides and plants are in periods of formation of productivity elements.

Bibliographic list

1. Авраменко С. В. Ранньовесняний догляд за посівами озимих зернових культур / С. В. Авраменко, М. Г. Цехмейструк // Агроном. – 2011. – № 1(31). – С. 70–71.
2. Дерменко О. П. Небезпечна хвороба пшениці озимої / О. П. Дерменко, Ю. С. Панченко, Л. Л. Гаврилюк // Карантин і захист рослин. – К., 2012. – № 11. – С. 4–7.
3. Косилович Г. Застосування фунгіцидів проти найпоширеніших хвороб озимої пшениці / Г. Косилович, П. Заяць // Вісник Львівського національного аграрного університету : агрономія. – 2010. – № 13. – С. 158–163.
4. Косилович Г. Використання фунгіцидів для захисту пшениці озимої від хвороб / Г. Косилович, М. Бурба // Вісник Львівського національного аграрного університету : агрономія. – 2012. – № 16. – С. 379–384.
5. Косилович Г. Ефективність використання нових пестицидів для захисту озимої пшениці від хвороб і шкідників / Г. Косилович, Р. Ващишин // Вісник Львівського національного аграрного університету : агрономія. – 2013. – № 17(2). – С. 344–350.

6. Косилович Г. Застосування нових фунгіцидів у системі захисту озимої пшениці від хвороб / Г. Косилович, І. Ліщинський // Вісник Львівського національного аграрного університету : агрономія. – 2014. – № 18. – С. 264–269.
7. Лихочвор В. В. Гербіциди внесли восени – мінеральні добрива зберегли / В. В. Лихочвор // Агро Еліта. – 2013. – № 7. – С. 18.
8. Проти комплексу хвороб / М. П. Гончаренко, С. В. Ретьман, О. В. Семеніхін, О. А. Копеніна // Карантин і захист рослин. – 2009. – № 6. – С. 20–22.
9. Ретьман С. В. Озима пшениця. Технологія захисту посівів з урахуванням конкретної фітосанітарної ситуації / С. В. Ретьман, І. М. Сторчоус, С. М. Бабич // Карантин і захист рослин. – 2006. – № 9. – С. 7–12.
10. Ретьман С. В. Особливості сівби озимих / С. В. Ретьман, О. В. Шевчук, Т. М. Кислих // Карантин і захист рослин. – 2008. – № 9. – С. 7–9.
11. Ретьман С. В. Фунгіциди нового покоління для захисту посівів озимої пшениці від фітоінфекції / С. В. Ретьман // Карантин і захист рослин. – 2007. – № 10. – С. 19–20.
12. Сторчоус І. Гербіцидна обробка восени по озимих: ріпаку та пшениці / І. Сторчоус // Агробізнес сьогодні. – 2013. – № 17(264). – С. 38–41.

EFFICIENCY OF BIOLOGICAL PROTECTION AND STIMULATION OF PEELED SAINFOIN SEEDS

S. Gavrish
P. 164–172. Bibl. 9.

Formulation of the problem. Problems in growing sainfoin are due to low germination and slow germination of seeds. The energy of germination of seeds is of great importance for obtaining guaranteed dense grass stand. Increase the energy of sainfoin seeds germination is possible by separating the fruit shells from them.

Scarification of seeds can lead to plant death due to mass colonization of parasitic organisms on unprotected organic matter of damaged seeds. Seed treatment with chemical preparations (fungicides) helps to prevent oppression and death of sainfoins, but pesticides can adversely affect the development of cultivated plants.

Biological preparations, unlike chemical ones, do not have a toxic effect on plants. Inoculation Seed treatment of seeds with growth regulators, microfertilizers and bacterial preparations significantly increases germination energy, laboratory and field germination.

The aim of the research is to determine the effectiveness of biological protection and stimulation of peeled sainfoin seeds.

Statement of the base material. In 2011–2013 the Donetsk State Agricultural Experimental Station of the NAAS of Ukraine developed and tested a peeled-grinding machine (PU 84442), which allows efficiently off sainfoin seeds.

Inoculation of peeled sainfoin seeds with a bacterial fungicid Aurill in combination with the biopreparations Rizobophyte and Phosphoenterin on the background of their inlay with the microfertilizer Reakom-S-Soya increased the field germination by 16,25 % compared to the untreated seeds.

The developed complex of biological protection and stimulation of peeled sainfoin seeds provides yield at the level of the preparation Vitavax 200 PF, the use of which allowed to obtain the yield of green mass in the first year of use of 31,8 t/ha, the second – 26,62 t/ha, seed yield – 0,93 and 0,78 t/ha, respectively. The use of biological protection and stimulation of peeled seeds ensured the yield of green mass in the first year of use of 31,68 t/ha, in the second – 27,10 t/ha, the seeds yield was 0,91 and 0,80 t/ha, respectively.

Conclusions. The developed complex of biological protection and stimulation of peeled sainfoin seeds is characterized by a fungicidal action, improves the balance of nutrients and provides yield at the level of the chemical preparation Vitavax 200 PF. The application of biological protection and stimulation of peeled sainfoin seeds allowed to increase by 1960,0 UAH net profit from 1 ha of sowing during three years of cultivation. At the same time, the profitability of production increased by 26,6 % and amounted to 93,6 %.

Bibliographic list

1. Гладкий М. Ф. Эспарцет : [монография] / Гладкий М. Ф., Корнилов А. А., Яценко Я. Л. – М. : Колос, 1971. – 128 с.
2. Пат. 84442 Украина, МПК B02B 3/02 (2006.01). Лущильно-шліфувальна машина / Гавриш С. Л. – № u201303708; заявл. 26.03.2013; опубл. 25.10.2013, Бюл. № 20.
3. Интегрированная защита растений : учебник / [Миренков Ю. А., Саскевич П. А. и др.]. – Минск : ИВЦ Минфина, 2008. – 360 с.
4. Патика В. П. Екологічні основи застосування біологічних засобів захисту рослин як альтернативи хімічним пестицидам / В. П. Патика, Т. Г. Омельянець // Агроекологічний журнал. – 2005. – № 2. – С. 21–24.
5. Мікроорганізми і альтернативне землеробство / [В. П. Патика, І. А. Тихонович, І. Д. Філіп'єв та ін.]. – К. : Урожай, 1993. – 178 с.
6. Микроудобрения и биодобавки для роста и развития растений / [А. Ю. Винаров, А. А. Кухаренко, А. Ю. Семенцов и др.]. – М. : Россельхозакадемия, 2002. – 85 с.
7. Белимов А. А. Смешанные культуры азотфиксирующих бактерий и перспективы их использования в земледелии / А. А. Белимов, А. П. Кожемяков // Сельскохозяйственная биология. Серия : Биология растений. – 1992. – № 5. – С. 78–79.
8. Belimov A. A. Interaction between barley and mixed cultures of nitrogen fixing and phoshatesolubilizing bacteria / A. A. Belimov, A. P. Kojemiakov, C. V. Chuvarliyeva // Plant and Soil. – 1995. – Vol. 173, № 1. – P. 29–37.
9. Лихочвор В. В. Біологічне рослинництво / В. В. Лихочвор. – Львів : НВФ Українські технології, 2004. – 312 с.

CHAPTER 7
AGROCHEMISTRY AND SOIL SCIENCE

THE SYSTEM OF EXTRACT AS A FACTOR OF BIOTOXIC SOIL POLLUTION

V. Lopushniak, d. s.-g. n.
Lviv National Agrarian University
P. 173–177. Bibl. 10.

Biotoxicity of the soil is manifested in suppressing the activity of its beneficial microflora and mesophane, which negatively affects the growth and development of higher plants and their productivity.

The research objective was to determine the influence of various fertilizer systems on the biotoxity of dark gray podzolized soil in the Western Forest-steppe of Ukraine due to changes in the number of fungi of the genus Penicillium.

In the conditions of stationary experiment of the Department of Agrochemistry and Soil Science of the Lviv National Agrarian University, studies were conducted on the influence of various fertilizer systems on the biotoxicity of dark gray podzolized soil during 2008–2015.

The alternation of crops in the short-rotational field of fruitful crop rotation was as follows: winter wheat – sugar beet – spring barley – clover rayon.

The scheme of the experiment involved control, mineral, organic and organo-mineral fertilizer systems with different saturations of organic fertilizers. As mineral fertilizers in the experiment, superphosphate was used as a simple granular, potassium salt, which was introduced into the main fertilizer. Ammonium nitrate was introduced under pre-planting and fertilization. How organic fertilizers were used were semi-pericarp straw manure of cattle, radish oil on siderate and winter wheat straw.

The total area of the experimental sites is 450 m^2, the registration number is 374 m^2, the repetition of the trial is three times, the site allocation is systematic. Soil biotoxy was determined in the field of sugar beet, as the main part of fertilizers in the crop rotation was introduced exactly under this culture, and in the field of winter wheat only the compensatory rate of mineral fertilizers was introduced. The development of fungi of genus *Penicillium* was determined in a two-percent potato-sucrose medium. Sowing of microorganisms was incubated in thermostats with a temperature of + 24 °C, and their record (amount of pendant organisms) was carried out in 3–5 days with the definition of the average. In our studies, depending on the growing season of sugar beet and fertilizer systems, the rates of biotoxic soil contamination varied significantly. In the phase of sugar beet seedlings in the control variant without fertilization, the level of biotoxicity was one of the highest in the experiment, and from rotation to rotation of crop rotation increased from 0.74 to 0.77 million CFU/g of soil. The highest index of biotoxicity was 0.82 and 0.86 million cuu/g of soil, only the variant of the mineral fertilizer system (option 2) was noted. Application of organo-mineral fertilizer system contributed to the reduction of biotoxic contamination compared to the mineral system and the option without fertilizer. However, the organo-mineral system with the highest rate of application of mineral fertilizers and saturation with organic fertilizers 6.25 t/ha

(option 3) provided for the growth of biotoxicity of the soil with each rotation of crop rotation in all phases of sugar beet growing.

Only the application of the organo-mineral fertilizer system with the saturation of organic fertilizers at least 12.5 t/ha positively affected the decrease of biotoxicity in the second rotation of crop rotation. In these options, biotoxic contamination in 2011–2014 was practically at the level of the previous research period. As the fertilizer system saturated with organic fertilizers, biotoxic soil pollution gradually decreased. The variant of the organic fertilizer system (option 6) was the lowest indicator of the number of fungi of the genus Penicillium, but this difference in the experimental conditions was unreliable in comparison with the indices of the organo-mineral fertilizer system, which had the highest index of saturation of organic fertilizers (15 t/ha) in both periods of implementation researches.

Conclusions. Fertilizer systems have a different effect on biotoxic soil contamination. Under the influence of the mineral fertilizer system, the number of toxic fungi of the genus Penicillium increases, and organo-mineral and organic fertilizer systems with organic fertilizer saturations of at least 15 t/ha of crop rotation provide a reliable reduction in the total number of fungi of the genus Penicillium in the field of sugar beet with each rotation of the field crop rotation before harvesting. the yield by 3.7–7.4 % for the first and for 14.9–20.2 % for the second rotation of the crop rotation compared with the variants of the mineral fertilizer system and the control variant without fertilization.

Bibliographic list

1. Векірчик К. Н. Мікробіологія з основами вірусології : підручник К. Н. Векірчик. – К. : Вища шк., 1997. – 232 с.

2. Долгілевич М. Й. Про ефективність добрив в оптимізації біологічної активності дерново-підзолистих ґрунтів Полісся / М. Й. Долгілевич, Б. Б. Котвицький, О. М. Пузняк // Вісник державної агроекологічної академії України. – 2000. – № 1. – С. 98–103.

3. Ефективні та екологічно безпечні системи удобрення в сівозмінах Західного Полісся та Лісостепу України : рекомендації / [Б. Б. Котвицький, М. Д. Демчук, В. І. Дудченко та ін.]. – Луцьк, 2006. – 59 с.

4. Лопушняк В. И. Система удобрения как фактор влияния на фитосанитарное состояние темно-серой оподзоленной почвы Западной Лесостепи Украины / В. И. Лопушняк // Биотехнология: реальность и перспективы в сельском хозяйстве : материалы Междунар. науч.-практ. конф., посвященной 100-летию СГАУ им. Н. И. Вавилова. – Саратов : КУБиК, 2013. – С. 155–156.

5. Лопушняк В. І. Вплив систем удобрення на біотоксичне забруднення опідзолених ґрунтів Західного Лісостепу України [Електронний ресурс] / В. І. Лопушняк // Актуальні проблеми агрохімії та ґрунтознавства : матеріали Міжнар. наук.-практ. конф., 18–19 лютого 2016 р. – Львів, 2016. – С. 281–287. – Режим доступу : http://lnau.lviv.ua/ lnau/index.php/uk/f-s/agro/kgza/news.html.

6. Мынбаева Б. Н. Установление токсичности почв Алматы через изменение состава микрофауны / Б. Н. Мынбаева, М. С. Панин, Б. К. Есимов // Известия Тульского государственного университета : естественные науки. – 2012. – Вып. 1. – С. 284–292.

7. Спосіб зниження ґрунтовтоми і фітотоксичності за вирощування сільськогосподарських культур в зерно-просапній сівозміні : патент на корисну модель № 85530 Україна, МПК A01B 79/02. № 201305754 / Лопушняк В. І. ; заявл. 07.05.2013; опубл. 25.11.2013, Бюл.

№ 22. – 2 с.
8. Терехова В. А. Значение микологических исследований для контроля качества почв / В. А. Терехова // Почвоведение. – 2007. – № 5. – С. 643–648.
9. Яковишин Т. Ф. Система біотестування токсичності ґрунту, забрудненого важкими металами / Т. Ф. Яковишин // Вісник Сумського НАУ : агрономія і біологія. – 2014. – Вип. 3 (27). – С. 70–72.
10. Яковлев А. С. Биологическая диагностика и мониторинг состояния почв / А. С. Яковлев // Почвоведение. – 2000. – № 1. – С. 70–79.

THE EFFICIENCY OF APPLICATION OF FERTILIZER IN THE CULTIVATION OF SPRING BARLEY

M. Vyslobodska, PhD, N. Veha, Degree-seeking student
Lviv National Agrarian University
P. 177–181. Bibl. 7.

The formulation of the problem. The barley is a leading cereal crop. The barley is the fourth largest in the world and the second in Ukraine in terms of area and gross charges. This crop is widely used as a forage culture and for industrial purposes in Ukraine (making groats and brewing). The provision of the domestic market by quality raw materials for the brewing industry remains an unresolved problem of agricultural production. According to experts' forecasts, the need for raw materials for the brewing industry may grow to 1 million tons in the long run. The high yield capacity and quality of grains of brewing barley is a real agricultural production ability in providing a balanced supply to the market needs of barley, as raw materials for brewing [1].

The application of mineral fertilizers is crucial in the complex of agrotechnical measures that provide high and stable yields of spring barley. Proper use of fertilizers increases not only the grain yield, but also changes its quality. However, different soil and climatic conditions, growing technologies and genotypes provide for clarification of fertilizer standards for the realization of the potential.

The main results of the research. The field experiments to study the influence of various backgrounds of mineral nutrition on the yield and quality of grain of spring barley of the Soncedar variety were conducted on the experimental field of the Department of Agricultural Chemistry and Soil Science Science of the Lviv National Agararnian University on the dark gray podzolized lightly-loamy soil. The soil of the studied field was characterized by the following agrochemical parameters: pH_{saline} – 6,3; the content of humus (by Thurin) in the arable layer of soil is low – 2,38–2,42%; the elements of nutrition: nitrogen, the low – 112 mg/kg, mobile phosphorus and exchangeable potassium (according to Chirikov) – medium, 85 and 80 mg / kg soil respectively, broad bean – predecessor. The research was conducted during 2014–2015. The scheme of experiment included options: 1) without fertilizers – control; 2) $N_{30}P_{30}K_{30}$; 3) $N_{60}P_{60}K_{60}$; 4) $N_{90}P_{90}K_{90}$.

The experiment used a complex fertilizer the nitrophoska with the contents of NPK 12:12:12, which was introduced according to the scheme of experiment in spring in pre-

sowing cultivation. The size of the experimental field is 50 square meters. The agricultural machinery used in the experimental field were typical for the zone of the Western Forest Steppe.

The calculations and analysis were carried out in accordance with generally accepted methods in agrochemical science [7].

The providing soil with easily digestible nutrients, the content of which is determined primarily by the type of soil, meteorological conditions of the year and fertilizers, is a significant factor affecting the productivity of the crops. Nitrogen is one of the main elements of the nutrition of spring barley. The need for this element arises from the beginning of the tillering period until it enters the tube. The study of the dynamics of easily hydrated nitrogen during the vegetation was showed that its largest amount in the soil was in the phase of stairs. In the process of growth and development of barley plants there was a gradual decrease in nitrogen content due to the use of its plants, but in variants with fertilizers before harvesting there was an increase in its content in the soil, which depended on the background of fertilization and was 7–16 mg / kg of soil compared with Control (without fertilizers).

The provision by phosphorous for barley has the greatest importance in the first period of development of plants. The positive role of phosphorus in this period is that this element enhances the growth of the root system. The phosphoric fasting at an early age leads to a disturbance of metabolism, inhibition of plant development. The application of fertilizers for spring barley increased the content of mobile phosphorus compounds in the soil. If on the control (before harvesting) the content of mobile phosphorus was 81 mg/kg of soil, then on the variants of the experiment with the application of fertilizers its content increased by 3–7 mg/kg of soil.

The highest need for potassium is observed at the beginning of the vegetation, until phase of colossus, and then the plant ended to absorb potassium. Potassium plays an active role in protein and carbohydrate metabolism in plants and activates the activity of enzymes. In carrying out the research, we found that the content of exchangeable potassium during the growing season varied depending on the phase of plant development and fertilization rates. Upon termination of vegetation of plants higher potassium content (99 mg/kg soil) in the version with the introduction of fertilizer standards $N_{90}P_{90}K_{90}$. An increase in potassium content in the soil relative to control is 18 mg/kg of soil.

The improvement of the conditions of nutrition of spring barley was reflected in the formation of grain yield and quality (Table 1). The fertilizer application contributed to a significant increase in the yield of the spring barley. The optimum for obtaining a stable crop of brewing barley was the norm of fertilizers $N_{60}P_{60}K_{60}$ kg/ha d.r. At this level of fertilizer application, the yield was 4.75 t/ha on average over two years of research. The growth in crop relative to control is 1.14 t/ha (31,6 %). The fertilizer rate $N_{30}P_{30}K_{30}$ was insufficient to create optimal conditions for the growing of spring barley, and the norm of $N_{90}P_{90}K_{90}$ was superfluous.

Conclusions. The application of fertilizers increases the content of organogenic elements in the soil. Highly more of the elements of nourishment are accumulated on versions with higher rate of fertilizers. The most favorable conditions for the formation of

the productivity of the spring barley of brewing direction of use on dark-green podzolic soils are created when fertilizing $N_{60}P_{60}K_{60}$ kg/ha d.r.

Bibliographic list

1. Марчук І. І. Застосування тукосумішей у сільському господарстві України / І. І. Марчук, А. А. Ященко // Посібник українського хлібороба. – 2011. – С. 114–118.
2. Городній М. М. Вплив 50-річного застосування добрив в зерно-буряковій сівозміні зони Лісостепу на врожайність та якість зерна ячменю ярого / М. М. Городній, Н. М. Білєра // Науковий вісник НАУ. – К., 2007. – Вип. 116. – С. 155–159.
3. Гораш О. С. Ефективність вирощування пивоварного ячменю ярого в умовах Західного Лісостепу / О. С. Гораш, М. Р. Рожик, В. В. Мастій // Вісник аграрної науки, – 2008. – № 5. – С. 41–49.
4. Жатов О. Г. Роль мінеральних добрив у процесі формування високоурожайного посіву ячменю / О. Г. Жатов, Г. В. Гуліда // Вісник Сумського НАУ: серія «Агрономія і біологія». – 2011. – Вип. 4. – С. 61–64.
5. Князев Б. М. Удобрение, урожай и качество зерна ярового ячменя / Б. М. Князев, М. Б. Хоконова // Зерновое хозяйство. – 2004. – № 3. – С. 21.
6. Бачинський О. В. Шлях підвищення продуктивності ячменю ярого пивоварного в умовах Північного Лісостепу України / О. В. Бачинський, Е. В. Качура // Вісник аграрної науки. – 2007. – № 8. – С. 44–49.
7. Доспехов Б. А. Методика полевого опыта / Б. А. Доспехов. – М. : Агропромиздат, 1985. – 350 с.

EFFECT OF MINERAL FERTILIZATION ON YIELD AND QUALITY OF POTATOES IN A DARK-GRAY PODZOLIC SOILS

B. Parkhuts, candidate of agricultural sciences
lviv National Agrarian University

P. 181–184. Bibl. 6.

Formulation of the problem. Potatoes increased requirements vary with the number of batteries necessary for the formation of a high quality and yield. Typically, early varieties learn less battery per unit of output than later [1; 5].

All soil types high yield of potatoes obtained by combined use of organic and mineral fertilizers [6].

The value of mineral fertilizers in the root potatoes power plants lies primarily in the fact that making them can create the optimal balance between nitrogen, phosphorus and potassium in all types of soil with different degrees of availability of nutrients [1; 3].

Standards fertilizer for potatoes set depending on the level of total projected yield, agricultural chemical indicators of soil fertility, the rules introduced organic fertilizers and predecessor [5].

Analysis of recent research and publications. According Geographic network experiments, the optimal rate of (not organic fertilizers) on sod-podzolic soils are $N_{120}P_{120}K_{90\text{-}120}$ to light gray and gray forest $N_{120}P_{90\text{-}120}K_{120}$ on dark gray forest and chernozem leached and podzolized $N_{60\text{-}120}P_{60\text{ -}120}K_{90\text{-}120}$ [2].

At 10 tonnes of tubers imposed $N_{40-70}P_{15-20}K_{60-90}Ca_6Mg_{6-8}S_6$, so you need to make more potassium assimilation which potatoes compared above. The best ratio of nitrogen, phosphorus, potassium and magnesium – N: P: K: Mg = 1,1: 1,0: 1,5: 0,5 [4].

Formulation of the task. The main objective of our research was to determine the features of formation of yield and quality of potato varieties Volja different rules depending on the mineral fertilizer in terms Horodok district, Lviv region on a dark gray ashed soils.

The main material. During 2014–2016 years spent study on the establishment of healthier fertilizers for potato varieties for growing in Wolia dark gray ashed soils in terms Horodok district, Lviv region.

Soils are characterized by average content of humus (2,2–2,6 %), slightly acidic soil solution (pH 6.4 salt) content light hydrolysis oxide (135 mg), mobile phosphorus (95 mg) and exchangeable potassium (115 mg) per 1 kg of soil.

Against the background of 30 t/ha manure made different rules fertilizers. Nitrogen fertilizer as ammonium sulfate (21% nitrogen and 24% sulfur) made spring presowing cultivation and phosphorus in the form of superphosphate double (40%) and potassium in the form kalimah (K_2O – 48 % MgO – 7 %) made fall under autumn plowing. Predecessor – winter wheat.

The highest yield of potato varieties Volja our experiment for 2014–2016 years (table 1) was the sixth version of the experiment and was 364 kg/ha, where the background of 30 t/ha manure fertilizers made in the normal $N_{90}P_{90}K_{120}$.

Table 1

Effect of mineral fertilizers on the yield and qualityof potatoes
(average for 2014–2016 pp.)

Option experiment	Yield, c/ha	Starch content, %	Exit starch, c/ha	Growth released starch	
				c/ha	%
Control – no fertilizer	184	15,4	28,3	-	-
30 t/ha manure – fond	252	15,6	39,3	11,0	38,9
fond + $N_{60}P_{60}K_{90}$	326	15,3	49,9	21,6	76,2
fond + $N_{70}P_{70}K_{100}$	338	15,1	51,0	22,7	80,3
fond + $N_{80}P_{80}K_{110}$	351	14,9	52,3	24,0	84,8
fond + $N_{90}P_{90}K_{120}$	364	14,7	53,5	25,2	89,1
HIP_{05}, c	6,8–7,3				

Compared with the background option (table 1) it gave increase potato yield 112 kg/ha or 44,4%. Somewhat lower productivity gains obtained in the third, fourth and fifth versions experiment where fertilizers were made at less than normal $N_{60}P_{60}K_{90}$, $N_{70}P_{70}K_{100}$, $N_{80}P_{80}K_{110}$. However, these options are given mathematically proved productivity gains control as well as to the background options.

The content of starch in potato tubers was the lowest in the variant of the experiment by making 30 t/ha manure + $N_{90}P_{90}K_{120}$ and amounted to 14,7 %, but its output on this option due to the high yield the highest – 53,5 c/ha. In other embodiments

of experience these indicators were slightly lower. By introducing only organic fertilizers normally 30 t/ha manure starch yield was 39,3 c/ha, which is 11,0 c/ha higher than the control.

Conclusions. In potato varieties Volja a dark gray ashed soils western steppes of Ukraine after predecessor winter wheat offered fertilization normally $N_{90}P_{90}K_{120}$ against the backdrop of 30 t/ha of manure. Nitrogen fertilizer in spring offer make presowing cultivation, and phosphorus and potassium in autumn autumn plowing. With this application rate of fertilizers in organic background can get the best performance of productivity and product quality.

Bibliographic list

1. Бондарчук А. А. Картопля / А. А. Бондарчук, М. Я. Молоцький, В. С. Куценко. – Біла Церква, 2007. – 536 с.
2. Господаренко Г. М. Агрохімія : підручник / Г. М. Господаренко. – К. : ННЦ «ІАЕ», 2010. – 400 с.
3. Довідник картопляра / [А. А. Кучко, В. С. Куценко, А. А. Осипчук та ін.] ; за ред. А. А. Кучка. – К. : Урожай, 1991. – 232 с.
4. Лихочвор В. В. Система удобрення картоплі / В. В. Лихочвор, П. Д. Завірюха, О. М. Андрушко // Агробізнес сьогодні. – 2014. – Травень, № 10. – С. 36–37.
5. Руденко Г.С. Система удобреннння картоплі / Г. С. Руденко, І. А. Ткачук ; за ред. В. Г. Батюти. – К. : Урожай, 1980. – 48 с.
6. Система застосування добрив : підручник / Лісовал А. П., Макаренко В. М., Кравченко С. М. – К. : Вища шк., 2002. – 317 с.

FERTILIZANION INFLUENCE ON HUMUS STATE IN THE DARK-GREY PODZOL SOILS OF RANGE LAND ALONG THE BUH

N. Lahush, PhD in agriculture, O. Haskevych, PhD in geography
Lviv National Agrarian University
P. 184–188. Bibl. 6.

The aim of research is to learn the impact of fertilizers on the structure of humus and its fractional and group contents in dark-grey podzol soils depending on the application of various standards of organic and mineral fertilizers.

The experimental plan foresaw control as well as mineral, organic and organically-mineral systems of fertilizing characterized by different indices of saturations with organic fertilizers: 1) Control (no fertilizers), 2) Mineral system of fertilizing NPK (the sum of NPK is 1030); 3) Organically-mineral system of fertilizing NPK, NPK of them are applied with mineral fertilizers (the sum of NPK is 1030), index of the crop rotation area saturation with organic fertilizers is 6,25 t/ha; 4) Organically-mineral system of fertilizing NPK (the sum of NPK is 1030), NPK of them are applied with mineral fertilizers, index of the crop rotation area saturation with organic fertilizers is 125 t/ha; 5) Organically-mineral system of fertilizing NPK (the sum of NPK is 1030), NPK of them is applied with mineral fertilizers, index of saturation with organic fertilizers is 15,0 t/ha; 6)

Organic system of fertilizing NPK, (the sum of NPK is 1030), index of saturation with organic fertilizers is 17,5 t/ha.

Mineral fertilizers in the form of elementary granular superphosphate were applied for the main fertilizing. Nitrogen fertilizers in the form of ammonia saltpeter were applied for the pre-sowing cultivation and additional fertilizing. Organic fertilizers were applied for sugar beets main fertilization in the form of half-rotten straw cattle manure and straw of grain crops (winter wheat varieties).

As we may see of the resulting data, the system of crops fertilizing influences greatly the contents of humus in soils. In particular, all experimental versions subjected to applying mineral and organic fertilizers demonstrated the increase of humus contents in tillage plasters of dark-grey podzol soils. The lowest increase of humus contents concerning the control under rotation of shift of crops was fixed at the experimental version of applying mineral system of fertilizing (the given index increased on 0,44 %). The highest increase of humus contents was secured by organically-mineral system of fertilizing characterized by maximal degree of saturation with organic fertilizers: humus contents here equaled 2,76 %.

Simultaneously with alterations in the total contents of humus we also fixed transformation of its fractional contents depending on the system of fertilizing.

In particular, the contents of free humic acids (HA-1) fraction in the tillage plaster increases from 9,38 % in the experimental version under control to 10,85 % on the plot subjected to organic system of fertilizing characterized by maximal saturation with organic fertilizers (experimental version No 6). If to examine a part of the fraction HA-1 in the total group of humic acids we may see that in the experimental version under control it equals 26,8 %. It insufficiently decreases to 26,4 % in the experimental version with mineral system of fertilizing and then gradually increases under conditions of applying organically-mineral system of fertilizing (to 27,2 % under conditions of the highest saturation of the crop rotation area with organic fertilizers).

Some alterations are also seen in the distribution of the fraction of humic acids connected with Ca (HA-2). The fraction contents increases from 16,60 % of the total humus structure in the experimental version under control to 18,92 % in the version No 6. The part of fraction in the total sum of humic acids is distributed by versions analogically with the fraction HA-1, i.e. it somewhat decreases in the 2nd version (47,3 %) comparing with the version under control (47,4 %). On the plot of organically-mineral and organic systems of fertilizing the part of humic acids connected with calcium ranges from 47,3 to 47,5 % of the total contents of HA. Thus, the high degree of the crop rotated area saturation with organic fertilizers causes the increase of the number of humic acids connected with calcium.

The contents of HA connected with one – and – a – half oxide and silt ranges from 25,3 to 26,3 % of the total contents of HA in different experimental versions. The maximal contents is fixed in the version of applying mineral system of fertilizing and minimal – in the versions of organically-mineral system of fertilizing.

The contents of fuivo-acids in the structure of humus also depends upon the system of fertilizing .In particular, the contents of movable and the most aggressive fractions of fulvo-acids (FA – 1a and FA – 1) is the highest on the plot under control (

accordingly, 6,58 and 7,77 %). Insufficient decrease of the number of given fractions is fixed on the plot of applying mineral system of fertilizing (6,45 and 7,67 % – version N0 2). In the versions No 1 and 2 their total number equals 42,2–42,3 %. Organically – mineral and organic systems of fertilizing cause sufficient decrease of the number of fractions FA – 1a and FA – 1. The increase of the degree of the crop rotation area saturation with organic fertilizers causes the decrease of the number of FA – 1a from 5,0 to 3,54 % and the number of FA – 1 – from 6,30 to 5,68 %. The total part of these fractions in the structure of fulvo – acids equals 34,5–32,5 %.

And, on the contrary, in the case of experimental versions distribution of fulvo – acids fractions connected with calcium we fixed the increase of their contents on the plots with organic system of fertilizing (12,7 % comparing with 12,4 % on the plot under control).

Thus, on the plot under control their part in the number of fuivo – acids equals 36,0 % and on the plot of the version No 6 it increases to 44,4 %.

The contents of FA-3 fractions, i.e. fulvo – acids connected with one – to – a – half oxides is distributed in the following way: its contents on the plot under control is maximal (7,34 % of the total humus structure). The FA – 3 contents in the versions with organically – mineral system of fertilizing ranges from 6,76 to 6,62. In the version No 6 subjected to organic system of fertilizing it equals 6,54 %.

Bibliographic list

1. Дегодюк С. Е. Вплив тривалого застосування добрив на трансформацію фізико-хімічних показників і загального гумусу в сірому лісовому ґрунті / С. Е. Дегодюк, А. В. Кириченко // Збалансоване природокористування. – 2015. – № 1. – С. 46–49.
2. Лопушняк В. І. Вплив систем удобрення на вміст гумусу в темно-сірому опідзоленому ґрунті Західного Лісостепу / В. І. Лопушняк // Вісник аграрної науки. – 2014. – № 2. – С. 5–9.
3. Лопушняк В. І. Динаміка фракційно-групового складу гумусу темно-сірого опідзоленого ґрунту під впливом різних систем удобрення / В. І. Лопушняк // Передгірне та гірське землеробство і тваринництво : міжвід. темат. наук. зб. – Львів ; Оброшине, 2012. – Вип. 54, ч. 2. – С. 58–63.
4. Мазур Г. А. Групово-фракційний склад і запаси гумусу в сірому лісовому ґрунті у зв'язку з інтенсивністю його використання / Г. А. Мазур, Т. І. Григора // Вісник ХНАУ. – 2011. – № 1. – С. 178–181.
5. Скрильник Є. В. Трансформація гумусного стану ґрунтів та їх енергоємності під впливом різних систем удобрення / Є. В. Скрильник // Вісник ЦНЗ АПВ Харківської області. – 2010. – Вип. 7. – С. 184–194.
6. Трансформація гумусу під впливом сівозміни і добрив / М. М. Єрмолаєв, Д. В. Літвінов, Л. І. Шиліна, Т. М. Єрмолаєва // Землеробство. – 2012. – Вип. 84. – С. 25–32.

BIOTOXIC STATE OF TURF PODZOLIC SOIL UNDER THE INFLUENCE OF FERTILIZERS WAS BASED ON THE SUWAGE SLUDGE

V. Lopushnyak[1], d. s.-g. n.,
G. Gritsulyak[2], k. s.-g. n.

[1]*Lviv National Agrarian University*
[2] *Ivano-Frankivsk college of Lviv National Agrarian University*
P. 189–193. Bibl. 11.

The restoration and increase of soil fertility, improvement of the root vegetable regime of plants are the basis for obtaining high and stable crops and is related to the regulation of the microflora of the soil. However, the intensity of the course of microbiological processes and their direction depend on the level of biotoxic contamination and the agro-ecological state of the soil.

In recent years, many scientists are considering the use of sewage sludge as fertilizers for various crops, in particular for energy. However, due to its irrational introduction, soil and environment pollution with heavy metals is possible, which in various concentrations is contained in the siege of sewage sludge. Therefore, it is important to control the level of biotoxic contamination of the soil, which determines the productivity of agrocenoses.

Getting from the soil in plant organisms in excessive amounts, heavy metals disturb their metabolism, which negatively affects the growth and development of plants, especially in the initial stages of ontogenesis. It is these particular features of the action of heavy metals on plant organisms that are taken into account during biotesting of the ecological state of the soil. Due to inhibition of life and reduction of biodiversity of physiological groups and the number of soil organisms, the rate of transformation processes of organic matter and the cycle of biogenic elements decreases.

Plants are the primary links in the trophic chains, play an important role in the absorption of various pollutants and are constantly exposed to them due to fixation on the substrate. That is why plants are considered the most convenient objects for biomonitoring and biotesting of soils.

The purpose of our study is to determine the level of soil toxicity for depositing sewage on sod-podzolic soils of Precarpathian as fertilizer for willow energy.

Scientific researches were carried out during 2012–2014 at the territory of the collegiate-research field of the Ivano-Frankivsk college of LNAU in Chukalivka Tysmenytsya district Ivano-Frankivsk region. The scheme of laying willow energy – 0,33x0,70 m. There are 10 variants.

For the study, we selected the soil samples testing under the thermostat conditions for t = (+ 25)°C. The phytotoxic effect was determined as a percentage of the weight of plants, the length of the root or stem system, the number of damaged plants or the number of stairs. In the process of searching for sensitive test objects to evaluate the level of soil toxicity in different experimental variants, we sprouted seeds of three different plant species, namely linseed common (Linum ustatissimum L.), one year old sunflower (Helianthus annuus L.), cress salad (Lepidium L. L.).

The plant's high sensitivity to the effect of sewage as a soil contaminant was established: the length of the root and the height of the flax of ordinary flax was 2.18–2.35 cm and 1.65–1.77 cm respectively. The coefficient of morphological variation was about 2.81 % for root length and 1.65 % for ramp height. The conducted soil analysis shows that the level of inhibition of the growth processes of phytoindicators in the test

variants for the introduction of compost (variants 6 – 10) though fluctuates between 34 and 39 % for ordinary linseed, annual sunflower and cress salad, but they determine the toxicity of the samples the ground at the level of "average". In soil samples, the toxicity of soil was noted within the "above average" level for the application of 40–80 t/ha of SGA.

The researches have established that the intensity of inhibition of plant growth processes-phytoindicators (ordinary linen, one-year-old sunflower and cress salad) indicate the toxicity of the soil at the level of "average" for the introduction of composts made on the basis of sewage sludge. For the fresh sedimentation of sewage in the norm of 40–80 t/ha, the toxicity of sod podzolic soils is "above average" level and fluctuates within 40 % of the phytotoxic effect.

Bibliographic list

1. Агрохімічне обслуговування сільськогосподарських формувань : навч. посіб. / [В. І. Лопушняк, І. О. Корчинський, І. М. Пархуць та ін.]. – Львів : Новий світ–2000, 2009. – 285 с.
2. Веремеєнко С. І. Застосування нетрадиційних заходів відновлення родючості ґрунтів / С. І. Веремеєнко, О. О. Олійник, Г. П. Сладковський // Вісник аграрної науки. – 1999. – № 12. – С. 5–8.
3. Гродзинський Д. М. Застосування рослинних тест-систем для оцінки комбінованої дії факторів різної природи / Д. М. Гродзинський, Ю. В. Шиліна, Н. К. Куцоконь. – К. : Фітооціоцентр, 2006. – 60 с.
4. Губачов О. І. Особливості використання рослин для біотестування з метою визначення рівня екологічної безпеки промислових територій / О. І. Губачов // Науковий вісник КУЕІТУ «Нові технології». – 2010. – № 3(29). – С. 164–171.
5. Козякова Н. О. Підхід до оцінки фітотоксичності ґрунту в умовах його забруднення Cd та Pb / Н. О. Козякова, В. М. Кавецький // Вісник аграрної науки Причорномор'я. – 2001. – Вип. 3(12), т. 2. – С. 63–69.
6. Моніторинг довкілля : підручник / [Боголюбов В. М., Клименко М. О., Мокін В. Б. та ін.] ; за ред. В. М. Боголюбова і Т. А. Сафранова. – Херсон, 2012. – 530 с.
7. Показатели экологической оценки почв, загрязненных тяжелыми металлами / С. С. Манджнева, Т. М. Минкина, Г. В. Мотузова [и др.] // Агрохімія і ґрунтознавство. – Харків, 2014. – Кн. 3. – С. 107–108.
8. Роїк М. Ефективність вирощування високопродуктивних енергетичних культур / М. Роїк, В. Курило, М. Гументик // Вісник Львівського національного аграрного університету. – 2011. – № 15(2). – С. 268–273.
9. Руденко С. С. Загальна екологія: практичний курс : навч. посіб. / С. С. Руденко, С. С. Костишин, Т. В. Морозова. – Чернівці : Рута, 2003. – Ч. 1. – 320 с.
10. 500 запитань і відповідей з агрохімії : навч.-довід. посіб. / [М. Й. Шевчук, В. І. Лопушняк, М. М. Вислободська та ін.] ; за ред. д. с.-г. н., професора В. І. Лопушняка. – Львів : ЛНАУ, 2016. – 476 с.
11. Comparison of the Phytotoxit microbiotest and chemical variables for toxicity evaluation of sediments / I. Czerniawska-Kusza, T. Ciesielczuk, G. Kusza, A. Cichoń // Environmental Toxicology. – 2006. – Vol. 21, Iss. 4. – P. 367–372.

THE INFLUENCE OF AGROCHEMICAL BACKGROUND OF PODZOLIC CHERNOZEM ON MICROELEMENTS CONTENT OF GRAIN WINTER WHEAT

A. Kutova, Phd agricultural sciences
National Scientific Center
"Institute for soil science and agrochemistry research named after O.N. Sokolovsky"
P. 193–198. Bibl. 12.

Formulation of the problem. Microelement composition of agricultural plants is an important indicator of their biological worth. The deviation of the content of elements in the grain from the optimal level towards increasing or decreasing has a direct bearing on the problem of human health. Both the scarce and excessive content of elements in food can manifest itself in the form of diseases – microelementoses (diseases caused by a violation of the balance of microelements in the human organism).

The purpose of the study was to study the effect of continuous application of fertilizers on podzolic chernozem on the microelement content of grain winter wheat.

Statement of the main material. The studies was carried out on the basis of stationary experience of the experimental farm "Grakovsky" National Scientific Center "Institute for soil science and agrochemistry research named after O.N. Sokolovsky". The soil of the experimental field – podzolic chernozem heavy loamy. During the period 1989–2009 was systematic application along of organic and mineral fertilizers created by two kinds of agrochemical background.

Inverse with the content of humus, the degree of acidity of the soil solution and the content of available compounds of cobalt, zinc and copper in the soil was determined.

Application of macrofertilizers increased the content of iron in wheat grain by an average of 24 %, cobalt by 50 % compared to the control, which increased the biological value of the crop was determined.

The grain of winter wheat contains 0,5–0,8 mg/kg of cobalt, 2,1–2,6 mg/kg of copper, 18,5–19,1 mg/kg of zinc and 25,7–32,9 mg/kg of iron was determined.

Conclusions. In the conditions of long systematic application of organic and mineral fertilizers, the topsoil layer of podzolic chernozem is characterized by a high content of humus, medium – of mineral nitrogen and available phosphorus, increased – available potassium and medium soil acidity level; available compounds content of microelements: high content of available cobalt, medium – of copper and low – of zinc (by DSTU 4362:2004). The available of microelements in the soil is affected by the humus content, soil acidity level and the increased content available phosphorus compounds. Long-term application fertilizers improves the biological worth of winter wheat grain by increasing the content of iron and cobalt.

Bibliographic list

1. Микроэлементозы человека: этиология, классификация, органопатология / [Авцын А. П., Жаворонков А. А., Риш М. А., Строчкова Л. С.]. – М. : Медицина, 1991. – 496 с.

2. Кузнецов В. А. Характеристика темно-серых лесных и черноземных почв Нижегородской области по содержанию микроэлементов и серы / В. А. Кузнецов // Плодородие. – 2010. – № 3(54). – С. 15–16.
3. Ермоленко Н. Ф. Микроэлементы и коллоиды почв / Н. Ф. Ермоленко. – [2-е изд.]. – Минск : Наука и техника, 1966. – 324 с.
4. Лукин С.В. Динамика содержания подвижных форм цинка и марганца в пахотных почвах Белгородской области / С.В. Лукин, П. М. Авраменко, С. В. Меленцова // Агрохимия. – 2006. – № 7. – С. 5–8.
5. Ясковець І. І. Модельні уявлення про процеси проникнення мікроелементів у кореневу систему рослин / І. І. Ясковець, Н. М. Протас, А В. Калініченко // Вісник Полтавської державної аграрної академії. – 2003. – № 3–4. – С. 8–10.
6. Елькина Г. Я. Поведение цинка в системе почва-растение в условиях европейского северо-востока / Г. Я. Елькина // Агрохимия. – 2009. – № 11. – С. 57–64.
7. Пейве Я. В. Биохимия почв / Я. В. Пейве. – М. : Сельхозгиз, 1961. – 422 с.
8. Федоров А. А. Новый подход к определению реально доступных растениям элементов питания в почве / А. А. Федоров // Агрохимия. – 2002. – № 7. – С. 32–39.
9. Господаренко Г. М. Вплив тривалого застосування добрив на вміст рухомих сполук мікроелементів у ґрунті / Г. М. Господаренко, О. О. Машинник // Вісник ХНАУ ім. В. В. Докучаєва. – 2011. – № 2. – С. 92–96.
10. Кляусова Ю. В. Эффективность микроудобрений при возделывании кукурузы на дерново-подзолистой супесчаной почве на разных уровнях минерального питания / Ю. В. Кляусова // Почвоведение и агрохимия. – 2009. – № 2. – С. 216–226.
11. Пироговская Г. В. Влияние жидких азотных удобрений на накопление меди в растениях яровой пшеницы на дерново-подзолистой легкосуглинистой почве / Г. В. Пироговская, А. Г. Ганусевич, Е. В. Овчинников // Почвоведение и агрохимия. – 2009. – № 2. – С. 137–150.
12. Цыганов А. Р. Микроэлементы и микроудобрения / Цыганов А. Р., Персикова Т. Ф., Реуцкая С. Ф. – Минск, 1998. – 122 с.

CHAPTER 8
LIVESTOCK PRODUCTION

MILK PRODUCTIVITY AND FATTY ACID COMPOSITION OF COW MILK UNDER CONDITIONS OF DIET ENRICHMENT WITH PROTECTED PLANT POLYENOIC ACIDS

S. Pavkovych, S. Vovk, V. Balkovskyi, M. Ivankiv
P. 199–203. Bibl. 10.

Problem setting. It is known that in rumen of ruminants, essential linoleic (omega-6) and linolenoic (omega-3) fatty acids are subjected to biohydrogenation under impact of symbiotic microflora ferments. Thus, share of the acids rapidly falls and share of saturated acids increases. The mentioned peculiarities of metabolism of polyunsaturated fatty acids in cow rumen is the reason of high level of saturated and low level of polyunsaturated, including essential, fatty acids in milk, substantially deteriorating its biological value. A set of researches proves that high share of saturated acids and small share of omega-3 fatty acids in diet of people causes increase of the number of coronary atherosclerosis cases and diseases of cardiovascular system. At the same time, it is defined that linoleic and linolenoic acids make anticarcinogenic and antiatherosclerotic effect in human body. According to recommendations of Ukrainian SRI of nutrition, ratio of polyunsaturated fatty acids omega-6:omega-3 in diet of healthy person should make approximately 9–10:1, and in case of lipid metabolism pathology it decreases to 5:1–3:1, while currently in Ukraine an average person consumes polyenoic fatty acids in ratio of omega-6:omega-3 within the limits of 10:1–30:1.

Analysis of the latest researches and publications. In recent years, one protects plant fatty components of diet before feeding by means of physical and chemical methods in order to reduce level of hydrogenation of polyenoic fatty acids by ferment systems of microorganisms in cattle forestomaches. Particularly, it is demonstrated that introduction of supplements of protected plant fats increases share of polyenoic fatty acids in content of lipids of milk and skeleton muscles, substantially improving their biological value.

Task setting. Aim of the work is to carry out a comparative research as to impact of supplements of linseed oil and calcium salts of fatty acids, made on its base, on milk productivity and fatty acid composition of milk.

Main material. The research was carried out on three groups of cows (10 heads in each) of Ukrainian black and pockmarked milk breed, selected according to the principle of similarities by age, lactation period, after-calving period, level of milk productivity and body weight in winter-spring stall-feeding period. In the experiment, we used 3-4–year-old cows of second lactation. Main diet contained hay, fodder beet, silage of maize and grain mixture with the following content: wheat middling – 50, barley

middling – 30 %, oats middling – 20 % (control group). Cows of the 2nd and 3rd groups (experimental) were on the main diet, which substituted a share of concentrates with 1,5 % of dry matter of linseed oil (the 2nd group) and calcium salts of fatty acids, made on its base (the 3rd group), during the 3-week period of the experiment, including one week of adaptation. Diets of control and experimental groups were of equal energy.

Amount of milk, obtained from an animal of each group was measured daily. In the samples of milk, we defined share of fat by acid method, total amount of protein – by the method of formol titration, share of lactose – by refractometric analysis. Fatty acid composition of milk fat was defined by Kurko method. The obtained results are processed biometrically with MS Excel program.

Use of linseed oil in diet of lactating cows causes some fall of daily average milk yield and share of fat, protein and lactose in it that results in decrease of yield of milk fat, protein and lactose in the experimental period.

Feeding of cows with calcium salts of fatty acids, made on its base, increases milk yield and content of fat and protein in it. At the same time, one notes some small fall of lactose level in milk. It is also found out that milk of the second group cows demonstrates decrease of organic matter share, while animals of the third group demonstrate some higher value of the mentioned indicator, comparing to the control.

Study of fatty acid composition of milk fat confirms that feeding of cows with supplements of linseed oil increases C_{18} level of fatty acids in content of milk fat. However, consumption of calcium salts of fatty acids, made on its base, lowers content of stearic and causes rise of the level of oleic, linoleic and linolenoic acids, while ratio of linoleic and linolenoic fatty acids is substantially decreased in the content of milk fat of the group animals.

Conclusions. Using supplements of calcium salts of fatty acids, made on the base of linseed oil, in diet of lactating cows, we observes rise of milk productivity and increase of the share of fat and protein in milk, decrease of the level of C_{14}-C_{16} acids and rise of the share of mono- and polyunsaturated fatty acids in content of milk fat.

Bibliographic list

1. Жирові добавки у годівлі тварин і птиці : монографія / [Вовк С. О., Снітинський В. В., Павкович С. Я., Кружель Б. Б.]. – Львів : СПОЛОМ, 2011. – 208 с.
2. Купажування олій з оптимізованим жирнокислотним складом / З. П. Федякіна, Т. В. Матвєєва, І. Є. Шаповалова, І. П. Петік // Вісник НТУ «ХПІ». Серія : Нові рішення в сучасних технологіях. – Харків : НТУ «ХПІ», 2013. – № 11(985). – С. 116–120.
3. Курко В. И. Газохроматографический анализ пищевых продуктов / В. И. Курко. – К. : Урожай, 1965. – С. 65–69.
4. Dietary sources of unsaturated fatty acids for animals and their subsequent availability in milk, meat and eggs / V. B. Woods, E. G. A. Forbes, D. L. Easson, A. M. Fearon. – AFBI Hillsborough, Large Park, Hillsborough, Co. Down, Northern Ireland, 2005. – 102 p.
5. Effects of ruminant *trans* fatty acids on cardiovascular disease and cancer : A comprehensive review of epidemiological, clinical, and mechanistic studies / [S. K. Gebauer, J. M. Chardigny, M. U. Jakobsen et al.] // Adv. Nutr. – 2011. – Vol. 2. – P. 332–354.
6. Grądzka I. *Cis-9,trans-11*-conjugated linoleic acid affects lipid raft composition and sensitizes human colorectal adenocarcinoma HT-29 cells to X-radiation / I. Grądzka, B. Sochanowicz, K. Brzóska // Biochim. Biophys. Acta General Subjects – 2013. – Vol. 1830. – P. 2233–2242.

7. Intakes of total fat, saturated, monounsaturated and polyunsaturated fatty acids in Irish children, teenagers and adults / T. Joyce, A. J. Wallace, S. N. McCarthy, M. J. Gibney // Public Health Nutr. – 2009. – Vol. 12. – P. 156–165.
8. Siegel G. Omega-3 fatty acids: Benefits for cardio-cerebro-vascular diseases / G. Siegel, E. Ermilov // Atherosclerosis. – 2012. – Vol. 225. – P. 291–295.
9. Supplementation with calcium salts of linoleic and trans-octadecenoic acids improves fertility of lactating dairy cows / [S. O. Juchem, R. L. Cerri, M. Villasenor et al.] // Reprod. Domest. Anim. – 2010. – Vol. 45. – P. 55–62.
10. Thanh L. P. Milk yield, composition, and fatty acid profile in dairy cows fed a high-concentrate diet blended with oil mixtures rich in polyunsaturated fatty acids / L. P. Thanh, W. Suksombat // Asian-Australas J. Anim. Sci. – 2015. – Vol. 28, N6. – P. 796–806.

EFFECT OF LEAD ON THE ACTIVITY OF ENZYMES OF ANTIOXIDANT SYSTEM IN BLOOD CELLS OF SCALY CARP

M. Onyskovets, N. Lopotich
Lviv National Agrarian University
P. 203–206. Bibl. 5.

Formulation of the problem. The results of study of the effects of lead on the indices of antioxidant system in blood cells of carp (Cyprinus carpio L.) are presented in the article. It is known that the main mechanism of lead toxicity is the development of oxidative stress as evidenced by disturbances in the pro-and antioxidant blood system as an integral indicator of the body status. In this regard, important is to ascertain the metabolic effects of lead in red blood cells that are among the first to fall under the influence of toxins altered internal environment and possess strong antioxidant defense system. The purpose of our study was to investigate the effect of lead on the activity of antioxidant enzymes in erythrocytes of scaly carp.

The main material. Experiments were performed on 2-year old fishes, which after the catching from natural pond were kept in aquaria under standard laboratory conditions. In our studies we used a two-year carp flake (Cyprinus carpio L.) with average weight 300–350 g. Each experimental group included in 7 animals. We investigated the influence of lead ions (Pb^{2+}) at a concentration of 0.2, 0.5 and 5 mg/l, corresponding to 2; 5 and 50 maximum permissible concentration (MPC) on the fish organism. After a period of acclimization the fishes of studied groups were kept in the presence of $Pb(CH_3COO)_2 \times 3H_2O$. Fish was kept in a medium with the addition of lead acetate for 96 h. The activities of enzymes of antioxidant system (superoxide dismutase, catalase) in erythrocytes of carp (Cyprinus carpio L.) were analysed.

As a result of the studies we found a significant increase in the activity of antioxidant enzymes during exposure of 2 and 5 MPC lead ions, and inhibition of enzyme activity at 50 MPC, indicating significant stress protective systems against the background of activation of oxidative stress. These data indicate that under superoxide dismutase and catalase activities is important factor of antioxidant defense in erythrocytes, protecting the cells of fish from the influence of heavy metals.

***Conclusions*.** As a result of the studies we found a significant increase in the activity of antioxidant enzymes during exposure of 2 and 5 MPC lead, and inhibition of enzyme activity at 50 MPC, indicating significant stress protective systems against the background of activation of oxidative stress. The data showed that the red blood cells of fish are particularly sensitive to oxidative stress induced by lead ions. The data showed that the red blood cells of fish are particularly sensitive to oxidative stress induced by lead ions, so urgent is to develop tools that would have warned accumulation of the free radical reactions products in these cells.

Bibliographic list

1. Дрогомирецька І. З. Експериментальне дослідження розподілу кадмію і нікелю в органах і тканинах *Cyprinus carpio* L. / І. З. Дрогомирецька, М. А. Мазепа, І. В. Мазепа // Современные проблемы токсикологии. – 2010. – № 4. – С. 39–42.
2. Особа І. А. Особливості функціонування системи антиоксидантного захисту організму / І. А. Особа // Рибогосподарська наука України. – 2009. – № 1. – С. 133–139.
3. Пилипенко Ю. В. Міграційні шляхи розповсюдження іонів важких металів в органах і тканинах риб-біомеліораторів в умовах малих водосховищ / Ю. В. Пилипенко, О. О. Бєдункова, Є. Ю. Пилипенко // Вісник НУВГП. – Рівне, 2007. – Вип. 2(38). – С. 313–318.
4. Функції металотіонеїнів та системи антиоксидантного захисту за дії Сота Zn-вмісних нанокомпозитів на карася сріблястого (Carassius auratus gibelio) / Г. І. Фальфушинська, Л. Л. Гнатишина, О. О. Турта [та ін.] // Український біохімічний журнал. – 2013. – Т. 85, № 3. – С. 52–61.
5. Adonaylo V. N. Lead intoxication: antioxidant defenses and oxidative damage in rat brain / V. N. Adonaylo, P. I. Oteiza // Toxicology. – 1999. – Vol. 135, N 2-3. – P. 77–85.

CORRECTION OF "E-SELEN" AGENT EFFECT ON PRODUCTIVITY OF YOUNG RABBITS UNDER TOXIC IMPACT OF CHROME (VI)

O. Skab, N. Khomych
Lviv National Agrarian University
P. 206–210. Bibl. 16.

Problem setting. In the last decades, level of environmental pollution with heavy metals has increased and caused great ecological threat [5]. Special attention should be paid to pollution of the environment with Chrome compounds. Every year, above 10^5 ton of Chrome enter environmental components with industrial residues [1]. Great threat for natural ecosystems is caused by hexavalent chromium (Cr (VI)), which is, contrary to trivalent one, characterized with a high level of toxicity and mutagenic effect on biota components [3].

Results of the current researches prove that income of Chrome (VI) is dangerous for health of agricultural animals. It can enter their body by digestive tract (with forage and water) and respiratory organs [2; 4]. It causes deterioration of the animals' health and worse quality of food products of animal origin.

Main material. The research was focused on study of the effect of Chrome (VI) on growth and development of animals, weight of internal organs, indicators of the

quality of muscular tissue and fur of young rabbits, who were given $K_2Cr_2O_7$ (potassium bichromate) with drinking water during 60 days in the norm of 5 mg/kg of living weight. Antioxidant agent "E-Selen" was applied also for prevention and correction of development of physiological deteriorations in rabbits, effected by Cr (VI).

The researches have determined that oral administration of $K_2Cr_2O_7$ reduces growth of living weight of animals by 15,9 % in the studied period, reduces slaughtering weight by 11,2 % ($p<0,05$), forces dynamics to decrease of the weight of some internal organs (lungs, heart muscle) and negatively effects quality of the animals' fur, i.e. deteriorates strength of its fibers by 12,8 % ($p<0,05$). At the same time, continuous income of $K_2Cr_2O_7$ deteriorates quality of rabbit meat because of less content of fat, i.e. by 12,3 % ($p<0,05$), and relatively higher content of stroma protein in biceps muscle of thigh, i.e. by 21,3 % ($p<0,05$).

Application of "E-Selen" agent for rabbits also neutralizes the harmful impact of dichromate-anion on rabbits productivity, normalizes slaughtering weight of rabbit bodies, weight of internal organs of animals and indicators of their fur quality, approaches content of fat and protein in biceps muscle of thigh to the control values.

Conclusions. The obtained results prove efficiency of application of "E-Selen" agent for prevention and correction of physiological deteriorations, caused by Chrome (VI) in rabbits' body, for decrease of the harmful impact of the element on health and productivity of animals under conditions of animal breeding on the territory, polluted with heavy metals.

Bibliographic list

1. Водяницкий Ю. Н. Тяжелые и сверхтяжелые металлы и металлоиды в загрязненных почвах / Ю. Н. Водяницкий. – М. : ГНУ Почвенный институт им. В.В. Докучаева Россельхозакадемии, 2009. – 95 с.

2. Екологічні аспекти оцінки стану ґрунтів сільських селітебних територій / Н. Палапа, І. Сігалова, С. Сенчук, О. Крикунова // Техніка і технології АПК. – 2011. – № 5(20). – С. 34–36.

3. A survey of selected heavy metal concentrations in Wisconsin dairy feeds / Y. Li, D. F. McCrory, J. M. Powell [et al.] // J. Dairy Sci. – 2005. – Vol. 88, N 8. – P. 2911–2922.

4. Contents of zinc, copper, chromium and manganese in silver foxes according to their age and mineral supplementation / W. Cybulski, L. Jarosz, A. Chałabis-Mazurek [et al.] // Pol. J. Vet. Sci. – 2009. – Vol. 12, N 3. – P. 339–345.

5. EPA (Environmental Protection Agency). National Air Pollution Emission Trends 1900–1998, 1998 Emissions, United States Environmental Protection Agency [Electronic resource]. – U.S. EPA, 2000. – Mode of access : http://www.epa.gov/ttnchie1/ trends/trends98/trends98. pdf.

6. EPA (Environmental Protection Agency). Chromium, Integrated Risk Information System. Washington, D.C. : Office of Health and Environmental Assessment [Electronic resource]. – U.S. EPA ; 1999. – Mode of access : www.epa.gov/iris/.

7. Erdogan S. Seasonal and locational effects on serum, milk, liver and kidney chromium, manganese, copper, zinc, and iron concentrations of dairy cows / S. Erdogan, S. Celik, Z. Erdogan // Biol. Trace Elem. Res. – 2004. – Vol. 98, N 1. – P. 51–61.

8. Estimation of chromium (VI) in various body parts of local chicken / M. Tariq, R. Rabia, A. Sakhawat [et al.] // J. Chem. Soc. Pakistan. – 2011. – Vol. 33, N 3. – P. 339–342.

9. Genotoxicity of tri- and hexavalent chromium compounds in vivo and their modes of action on DNA damage in vitro / Z. Fang, M. Zhao, H. Zhen[et al.] // PLoS One. – 2014. – Vol. 9, N 8. – P. 103–194.
10. Heavy metals and other elements in serum of cattle from organic and conventional farms / A. Tomza-Marciniak, B. Pilarczyk, M. Bąkowska [et al.] // Biol. Trace Elem. Res. – 2011. – Vol. 143, N 2. – P. 863–870.
11. Kumar S. Chromium (VI) influenced nutritive value of forage sorghum (Sorghum bicolor L.) / S. Kumar, U.N. Joshi, S. Sangwan // Anim. Feed Sci. Technol. – 2010. – Vol. 160, N 3–4. – P. 121–127.
12. Niki E. Evidence for beneficial effects of vitamin E / E. Niki // Korean J. Intern. Med. – 2015. – Vol. 30, N 5. – P. 571–579.
13. Selenium in human health and disease / S. J. Fairweather-Tait, Y. Bao, M. R. Broadley [at el.] // Antioxid. Redox Signal. – 2011. – Vol. 14, N 7. – P. 1337–1383.
14. Surai P.F. Selenium in pig nutrition and reproduction: boars and semen quality-a review / P. F. Surai, V. I. Fisinin // Asian-Australas J. Anim. Sci. – 2015. – Vol. 28, N 5. – P. 730–746.
15. The determination of chromium in feeds by flame atomic absorption spectrophotometry / J. Wang, B. Jia, L.P. Guo, Q.P. Lin // Guang Pu Xue Yu Guang Pu Fen Xi. – 2005. – Vol. 25, N 7. – P. 1142–1144.
16. Zhang R.H. Remediation of chromate contaminated soils by combined technology of electrokinetic and iron PRB / R. H. Zhang, H.W. Sun // Huan Jing Ke Xue. – 2007. – Vol. 28, N 5. – P. 1131–1136.

CONCENTRATION OF LIPID PEROXIDATION PRODUCTS IN ERYTHROCYTES AND BONE MARROW CELLS OF RATS AS INDICATOR OF TOXIC BACKGROUND EVOKED BY CADMIUM IONS

Y. Zhylischich[1], H. Antonyak[2], N. Panas[1], N. Kachmar[1], B. Krektun[1], O. Mentuh[1],
[1]Lviv National Agrarian University,
[2]Lviv Ivan Franko National University
P. 211–215. Bibl. 10.

Identification of problem. The Cadmium cations are the stress factors stimulating active Oxygen forms (AOFs) process generation in different types of cells. Active prooxidant effect of AOFs evokes different harmful effects: intensification of peroxide oxidation of lipids, oxidative injures of protein and nucleic acids molecules. Integrity and stability of cell membrane structures in grate extent influence on functional characteristics of hemopoietic cells and their ability to support of erythropoiesis processes. These changes, in the erythrocytes, directly influence on oxygen transport function of hemoglobin and rheological characteristic of blood.

The aim of our research consisted in clarifying of lipids peroxidation products (TBA-active products) concentration dynamics in erythrocytes and bone marrow cells of rats as a result of toxication by Cd^{2+} cations in condition of long term administration of $CdCl_2$ in dose of 3 mg/kg.

Materials and methods. The experimental procedure was carried out in conditions of the vivarium with the use of white nonlinear rats weighing 160–180 g. The

rats were divided on next groups: control group (K, 10 animals) and 4 experimental groups (D_1, D_2, D_3, D_4) which included of 5 animals each. The rats of experimental groups were intragastrical given of $CdCl_2$ in dose of 3 mg/kg daily: the animal of D_1 group were treated during 7days; D_2 group – 14 days; D_3 group – 21 days; D_4 group – 28 days. The rats of the control group received physiological solution in the same volume.

Tissue of bone marrow and blood have been taken after decapitation of rats and investigated in experiment. The erythrocytes were separated from heparinized blood and erythroblasts of bone marrow from epiphysis of thigh bones.

Results and Discussion. Results of the research have proven the considerable sensitivity of erythroid cells to cadmium as a stress factor stimulating processes of lipids peroxidation. It was established that after injection of $CdCl_2$ solution the end products of lipids peroxidation accumulated in erythrocytes and bone marrow erythroblasts of the rats.The dynamic of these changes in studied cells showed some peculiarities. The concentrations of thiobarbituric acid reactive substances (TBARS) was much more visibly risen (on 60,7 per cent, $P<0,01$) in erythrocytes of group D1 animals which were injected by cadmium chloride during 7 day , than erythroid cells of bone marrow (on 36,8 per cent, $p<0,05$). The next stages of experiment were characterized by increasing of TBARS concentrations in erythroid cells of bone marrow in greater extent than in blood erythrocytes. In erythrocytes of rats which received the cadmium chloride solution during 14, 21 and 28 days, this value increase on 53,4, 85,0 i 62,0 per cent ($p<0,05$-$0,01$) respectively, while in bone marrow cells this increase was in 1,9, 2,1 and 1,8 folds ($p<0,001$) respectively. The highest level of LP end products accumulation was manifested in rats of D3 group (21 day of experimental injection of cadmium chloride) with 2,1–fold increase in erythroid cells of bone marrow and with the 1,85-fold in erythrocytes.

Conclusions. The cadmium chloride injection in dose of 3 mg per kg during 28 days results considerable increase of TBA-reactive products in blood erythrocytes and erythroid cells of rat bone marrow. Increase of TBA-active products concentration was more explicitly manifested in erythroid cells of bone marrow than in the blood erythrocytes. In erythrocytes of rats, which were injected by cadmium solution during 14, 21 and 28 days, these indices increased on 53,4, 85,0 i 62,0 per cent ($p<0,05$–$0,01$) respectively while in bone marrow cells in 1,9, 2,1 and 1,8-fold respectively.

Bibliographic list

1. Гаврилов О. К. Клетки костного мозга и периферической крови / О. К. Гаврилов, Г. И. Козинец, Н. В. Черняк. – М. : Медицина, 1985. – 286 с.

2. Кадмій в організмі людини і тварин: І. Надходження до клітин і акумуляція / Г. Л. Антоняк, Л. П. Білецька, Н. О. Бабич [та ін.] // Біологічні студії. – 2010. – Т. 4, № 2. – С. 39–52.

3. Орехович В. Н. Современные методы в биохимии / В. Н. Орехович. – М. : Медицина, 1977. – 391 с.

4. Северин С. Е. Практикум по биохимии / С. Е. Северин, Г. А. Соловйов. – М. : Изд-во МГУ, 1989. – 509 с.

5. Diphenyl diselenide reverses cadmium-induced oxidative damage on mice tissues / Santos F. W., Zeni G., Rocha J. B. [et al.] // Chem. Biol. Interact. – 2005. – Vol. 151, N 3. – P. 159–165.

6. Free radicals, metals and antioxidants in oxidative stress-induced cancer / Valko M., Rhodes C. J., Moncol J. [et al.] // Chem. Biol. Interact. – 2006. – Vol. 160, N 1. – P. 1–40.
7. Liu J. Role of oxidative stress in cadmium toxicity and carcinogenesis / Liu J., Qu W., Kadiiska M. B. // Toxicol. Appl. Pharmacol. – 2009. – Vol. 238, N 3. – P. 209–214.
8. Mechanism of DNA damage by cadmium and interplay of antioxidant enzymes and agents / Badisa V. L., Latinwo L. M., Odewumi C. O. [et al.] // En virón Toxicol – 2007. – Vol. 2. – P. 144–151.
9. Moulis J. M. Celtular mechanisms of cadmium toxicity related to the homeostasis of essential metals / Moulis J. M. // Biometals. – 2010. – Vol. 23, N 5. – P. 877–896.
10. N-acetylcysteine prevents memory deficits, the decrease in acetylcholinesterase activity and oxidative stress in rats exposed to cadmium / Gonçalves J. F., Fiorenza A. M., Spanevello R. M. [et al.] // Chem. Biol. Interact. – 2010. – Vol. 186, N 1. – P. 53–60.