diameter of the shoot, from which they are harvested. For cuttings, the diameter of which in the basal part was more than 8.2 mm, rooting was the best (80.5 ... 80.5%). With a decrease in the diameter of the basal part of the stem, their rooting rate decreased markedly (76.0 ... 0.00%). However, other characteristics of the shoot, from which they were harvested (water content of tissues, the number of nodes), to a lesser extent influenced the studied parameter.

Analyzing the average values characterizing the source material for cuttings, it is not possible to isolate the trends of these or those indicators according to the characteristics of the general array of the general population. The average length of shoots suitable for cuttings is 120 cm, the average diameter is 6.0 mm. Shoots with such indicators provide a share of rooting of about half of the planted cuttings (46.0%). At the same time, the average indicators do not allow to isolate that part of the cuttings that provide a sufficiently high degree of rooting. It is impossible to separate the part that needs to be used already at the first stage of reproduction - harvesting shoots.

The generalization of the average biometric indicators of the source material of the clone stock of the pumiselect (increments of last year) without ranking it during reproduction by grafting does not allow to establish the criteria by which this method of reproduction is appropriate. Perhaps the simplest and most obvious criterion for evaluating cuttings that root well is their diameter. The existing technology for the cultivation of clonal rootstocks of fruit crops by the cuttings method as applied to the root of the pumicelect provides a high degree of rooting of lignified cuttings, provided that their diameter in the lower part is at least 7.0 mm.

Key words: *biometric characteristic, clone stock, lignified cuttings, pumyselect, rooting.*

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DREG AS AN ALTERNATIVE ORGANIC FERTILIZER FOR SOIL

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У статті досліджується проблема про можливість використання післяспиртової барди як альтернативне внесення органічного добрива у сільськогосподарські землі. Однією із причин дегуміфікації та погіршення агрономічних властивостей сільськогосподарських земель є

неконтрольоване внесення мінеральних добрив. Лише науковий агроекологічний підхід, а саме – розрахунок балансу поживних речовин та гумусу залежно від вирощуваної сільськогосподарської культури, а також фізичних, хімічних і біологічних характеристик ґрунту забезпечать підтримку рівня поживних речовин у ґрунтах агрогосподарств. Внесенням післяспиртової барди як органічного добрива господарники збільшують елементами азоту ґрунт, що становить науковий і практичний інтерес для агрохімії, забезпечує трансформацію азоту в системі «ґрунт – добриво – рослина» з метою збільшення продуктивності сільськогосподарських культур високої якості в біологічному відношенні.

Ключові слова: *ґрунт, дегуміфікація, добрива, барда, поживні речовини*

Introduction. At the present stage of agricultural development, the leading role is given to resource-saving technologies for growing crops. Given the high cost of mineral fertilizers and the lack of sufficient manure due to a sharp decline in livestock, local organic fertilizer resources should be found (Baliuk; Stashuka). One of such cheap sources can be the waste of alcohol production - post-alcohol dreg. Alcohol dreg is an environmentally friendly fertilizer. The concentration of salts of heavy metals in it is much lower. At the same time, the total nitrogen content of the dreg exceeds 5–7 times the litter and 25–30 times the litterless manure, which indicates its nutritious character .

Analysis of recent research and publications. In the environmental aspect, it is important to make the optimum dose of organic matter to protect the environment and obtain environmentally friendly crop products. Also, alcohol dreg is not a source of accumulation of harmful substances in crop production; in chemical composition, it is an environmentally friendly fertilizer containing various valuable organic substances of natural origin, a wide range of macro and microelements and can be a promising organic fertilizer, a plant growth promoter and a source of soil biogenicity [1, 2].

The problem of alcohol production wastes (APW) is due to the large amount of accumulation in the adjacent areas of the plants in the ponds. The presence of significant mineralization and substances of organic origin in the APW, as well as the high temperature, make it impossible to dispose of waste into the sewage network and to recycle it in production creates the conditions for further increase of the area under new capacities. This leads to the exclusion of fertile areas from

agricultural production, additional costs for the maintenance of sedimentation tanks, air pollution by volatile substances with an unpleasant odor [3, 4].

At the same time, in recent years there has been a depletion of soils into the main nutrients due to the scarcity of traditional organic and expensive mineral fertilizers. Partially the lack of basic nutrients, trace elements and organic matter in the soil can be replenished by fertilizing irrigation. At the same time, due to the large irrigation standards, the fertilizer becomes moisture-charged in nature, which allows to provide plants with the necessary moisture, especially in the initial stages of organogenesis. This opportunity has become relevant in recent years, when there is a rather unstable moisture due to lack of rainfall in the spring [5].

Due to the unbalanced nutrient content of the relatively high mineralization of APW, it is important to study the impact of different waste standards on the soil-plant system, in particular the ecological status of soils, their fertility, physical properties and biological activity, crop yields and quality of agricultural products. These issues have become relevant from an environmental point of view, since studies on high rates of introduction and the possibility of using APW in one place for several years are insufficient at present. Studying these aspects will make it possible to dispose of APW, preventing their systematic introduction and harmful effects on soil and crops [6, 7].

The subject of research is ecologically safe norms for the utilization of alcohol production waste, the ecological state of the typical black soil.

The main tasks are to investigate and analyze the chemical composition and properties of the APW of Kozliv Distillery in order to determine their suitability for fertilizers of agricultural crops. To carry out the analysis of studies of the influence of different doses of WWW on the ecological status and fertility of typical heavy loamy soil, its physico-chemical, physical, chemical, biological properties, with the identification of possible negative consequences of the use of APW.

Research methodology. The object of research is the use as an alternative organic fertilizer of the post-alcohol dreg (PLC distillery of Kozliv, Kozova district, Ternopil region) and the process of its influence on the fertility and ecological status of typical black soil (agricultural lands of agricultural farms of the same region).

Research methods: field, laboratory methods, methods of mathematical statistics. For the survey of soils of agricultural enterprises of the Ternopil region of Kozova district, the results of researches conducted in accordance with the

requirements of the guidelines, methodical instructions, recommendations of DSTU, GOST and TU were used. Sampling of soil samples was performed according to the methodology of continuous soil-agrochemical monitoring of agricultural lands of Ukraine (1994) [7]. Soil agrochemical indices were determined by conventional methods: humus content (organic matter) - by Tiuryn method in Simakov's modification (DSTU 4289: 2004); the content of alkaline hydrolyzed nitrogen - by the Cornfield method according to the "Method, instructions for the determination of alkaline hydrolyzable nitrogen in soil, M., 1985"; mobile forms of phosphorus and metabolic potassium - by the Chirikov method (DSTU - 4115– 2002); the degree of acidity (pH) - potentiometrically by the method of CINAO (GOST 26483-85) and hydrolytic by the method of Kapen - (GOST 26212-91) [8].

Technological indices of the viscosity of the wort and filtrate of the post-alcohol dreg were determined using a Brookfield DV-E viscometer.

In the mature specimen, pH and active acidity were determined by electrometric method, the content in the mature specimen of soluble carbohydrates, insoluble starch, alcohol-soluble carbohydrates and dextrins - photoelectrocolorimetric method with an anthrone reagent [8].

Results of researches. In Ukraine, grain dreg resources are quite significant, considering the volume of alcohol production of the Ukrspyrt concern - 650 million liters each year (81 state-owned enterprises and 30 associate members with different ownership). At the same time, the volume of post-alcohol bards according to modern technology is for every 1 l of alcohol 11-15 l of dreg. However, it cannot be stored, quickly acidified, and requires considerable transportation costs to the consumer. The dumping of dreg by distilleries in rivers leads to a significant deterioration of the environmental situation. Its solids accumulate in water pipes and river beds, decompose and pollute the environment. The object of study was selected the distillery of the village Kozliv of Ternopil region where molasses and corn grain are used as raw material. At full capacity, the company produces about 600 m^3 of bards per day. The dreg, as one of the emissions from alcohol production in most plants, is not utilized and, without wastewater treatment, is discharged into the sump where it decays, polluting groundwater and air. Distilleries add methane from the filtration fields to natural methane emissions, enhancing the greenhouse effect on the planet.

The wastewater of distilleries is characterized by a high degree of pollution. Large volumes represent a significant environmental hazard. Moreover, they are not toxic by themselves, but when they get into groundwater, ponds and rivers,

they quickly deplete the oxygen reserves that cause the death of the inhabitants of these reservoirs.

The main problem with post-alcohol dreg disposal is the processing of the liquid phase, the so-called «fugue», which accounts for up to 92% of all runoff. Wastewater organic matter quickly becomes fermented and dies. About 70% of the pollution of these sewage is decomposed within the first days. As a result of decay, protein substances decompose into amino acids, carbon dioxide and ammonia. Acetic, lactic, butyric and propionic acids are formed during the fermentation of the sugars contained in the wastewater.

The wastewater of the alcohol industry, which drains into the filtration fields, open reservoirs, quickly rot, emit odors, and is also the cause of insect reproduction. These contaminants are distributed fairly unevenly within the air basin, and their concentration in the air in some areas may reach a health-threatening population. In addition, the dreg loses the nutrients contained in it.

Creating filtration fields requires the allocation of large tracts of land that could be used for agricultural production. At present, the water treatment of distilleries is at a very low level. With the development of science and technology, with increasing concentration of production, industrial waste management becomes economically feasible, as with the increase in production, the amount of waste and the cost of the substances contained therein increases. Sometimes the cost of these substances exceeds the cost of the product from which the waste is produced.

At different plants, the composition of dreg may vary depending on the alcohol production technology used, but the differences are not fundamental. Its chemical composition as a percentage is as follows: water 93,7-94,5%; solids 5.5–6.3%; including nitrogen-free extractives 2.76-2.86%; fat 0.03-0.08%; cellulose 1.21–1.37%; minerals (ash) 0.5-0.8%. The alcohol dreg after purification and deposition contains: nitrogen nitrate 17.5 mg / l, nitrite 186 mg / l, Zinc 0.011 mg / l, Nickel 0.002 mg / l, Manganese 0.011 mg / l, Silver 0.00001 mg / l, Cobalt 0.017 milligrams / liter, Vanadium 0.006 milligrams / liter, Iron 0.6 milligrams / liter. The nitrogen compounds (nitrates and nitrite) contained in the dreg completely replace the nitrogen fertilizers introduced in the amount of 30 kg / ha of the active substance. In addition to the above elements, the bard contains (% by dry matter): protein 25–28 non-nitrogenous substances 40–42, lipids 5–6, fiber 13–18, ash 7–6. These substances contribute to the development of all soil microflora. The alcohol Dreg has an acidic medium reaction (pH 4.8-5.2). With the help of straw (approximately 5-6 t / ha), which has an alkaline reaction, soil

acidification does not occur, only the process of its decomposition is accelerated. At higher concentrations (more than 200 l / ha) the soil is acidified, which negatively affects the development of sown crops and the activity of soil microflora.

Analysis of the composition of the water extract from the soil investigation indicates significant changes that occurred in the cationic anion composition (Table 1).

Table. 1.Salt composition of water extract of typical black earth soil, mg-eq / 100g of soil, (average).

depth, cm	Alkalinity		Cl^-	SO_4^{2-}	Ca^{2+}	Mg^{2+}	Na^+	K^+	Sum of salts, %	
	CO_3^{2-}	HCO_3^{2-}							total	Including toxic
control (without irrigation)										
0–30	it is no	0,20	0,04	0,30	0,26	0,10	0,15	0,04	0,038	0,029
30–60	– « –	0,16	0,06	0,32	0,25	0,15	0,10	0,06	0,039	0,027
60–100	– « –	0,17	0,04	0,26	0,39	0,15	0,10	0,04	0,037	0,023
water of 1000 t/ hectare										
0–30	– « –	0,28	0,08	0,35	0,30	0,15	0,18	0,06	0,051	0,037
30–60	– « –	0,26	0,08	0,40	0,38	0,13	0,20	0,07	0,054	0,039
60–100	– « –	0,32	0,06	0,44	0,42	0,15	0,22	0,08	0,061	0,043
500 t/ hectare wastes of a spirit production										
0–30	– « –	0,40	0,10	0,40	0,25	0,18	0,22	0,28	0,069	0,046
30–60	– « –	0,42	0,12	0,44	0,20	0,20	0,25	0,30	0,075	0,051
60–100	– « –	0,48	0,10	0,42	0,20	0,17	0,30	0,31	0,078	0,053
750 t/ hectare wastes of a spirit production										
0–30	– « –	0,45	0,12	0,54	0,18	0,22	0,25	0,55	0,090	0,057
30–60	– « –	0,44	0,18	0,75	0,12	0,20	0,34	0,52	0,101	0,069
60–100	– « –	0,50	0,15	0,65	0,12	0,18	0,32	0,49	0,097	0,066
1000 t/ hectare wastes of a spirit production										
0–30	– « –	0,50	0,20	0,70	0,09	0,26	0,26	0,74	0,127	0,071
30–60	– « –	0,52	0,22	0,80	0,12	0,21	0,40	0,90	0,127	0,077
60–100	– « –	0,48	0,16	0,72	0,10	0,18	0,40	0,68	0,109	0,070

The sum of the exchange bases under the influence of APW increased, indicating the absorption of maximum production concentration that the exchange of cations, in particular Na^+, K^+, Mg^{2+}, NH^{4+}, etc., which are characteristic of this waste, is absorbed by the MPC. The analysis of the dynamics of the sum of

the exchange bases during the 2016–2018 years in the arable layer makes it possible to confirm that after further introduction of MPC it is more saturated with exchange cations. The content of cations did not have a tendency to increase only with calcium, the content of which was reduced due to the significant saturation of the soil solution with potassium and sodium and, accordingly, its displacement. The magnesium content increased 1.8 times, sodium - 1.5 times, potassium - 7 times. With the maximum dose of HRV, the amount of hydrocarbonates increased by 2.5 times, chlorides - by 5 times, sulfates - by 2.3, magnesium - by 2.6, sodium - by 1.7 and potassium - by 18.5 times, and the amount of calcium decreased by 2.8 times.

The regression analysis showed a tendency for an increase in the curvature of the curvilinear dependence with an increase in the dose of BCS. The three-year application affected the accumulation of salts in this way. When applying the maximum dose, the content of hydrocarbonates in the arable layer increased by 2.7 (from 2.1 to 5.7) times, chlorides - by 6 (from 0.04 to 0.24), sulfates - by 3.8 times (from 0.30 to 1.14 mg-eq / 100 g). Concerning cations: calcium decreased by 2.4 times, magnesium increased by 3.1, sodium by 2 and potassium by 30.5 times. Thus, the three-year introduction of WWW in all tested doses did not cause soil salinization, but the use of large doses will critically approximate the soil salinity limit. Therefore, it is best to recommend limited doses for 3 years, given the dangers of salting.

Conclusions. Therefore, in order to reduce the negative environmental impact of alcohol production, namely post-alcohol bards, it is proposed to use marshmallow as a fertilizer for crops. Ethyl alcohol production at this plant can be considered appropriate and environmentally friendly. One of the advantages is the close location of farms, which reduces the cost of transporting the dreg.

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Аннотация

Гловин Н. М., Павлив О. В., Кравченко В.С.

Барда как альтернативное органическое удобрение для почвы

В статье исследуется проблема о возможности использования послеспиртовой барды в качестве альтернативного внесение органического удобрения в сельскохозяйственные земли. Одной из причин дегумификации и ухудшение агрономических свойств сельскохозяйственных земель является неконтролируемое внесения минеральных удобрений. Только научный агроэкологический подход, а именно - расчет баланса питательных веществ и гумуса в зависимости от выращиваемой сельскохозяйственной культуры, а также физических, химических и биологических характеристик почвы обеспечат поддержание уровня питательных веществ в почвах агрохозяйств. Внесением послеспиртовой барды в качестве органического удобрения хозяйственники увеличивают элементами азота грунт, представляет научный и практический интерес для агрохимии, обеспечивает трансформацию азота в системе «почва - удобрение - растение» с целью увеличения продуктивности сельскохозяйственных культур высокого качества в биологическом отношении. Учеными в данной области ведутся системные исследования, направленные на разработку ресурсо- и энергосберегающих технологий спиртового производства и снижения влияния вредных отходов на окружающую среду. В частности -утилизация послеспиртовой барды и повышение экологизации производства. Проводили исследования и анализ химического состава и свойств выбросов спиртового производства ГП «Козловский спиртзавод» с целью установления их пригодности для удобрительных поливов сельскохозяйственных культур. Зерновая барда в основном попадает на поля фильтрации, негативно влияет на окружающую среду и загрязняет земли сельскохозяйственного назначения. Барда неоднородна жидкость с измельченными частицами зерна, светло-коричневого или желтого цвета с запахом зерна или другого сырья. Активная кислотность (pH) ее составляет 3,8 ... 4,6. По разным литературным данным, содержание сухих веществ в барде с различной исходного сырья составляет около 10%. В расчете на сухое вещество в ней содержатся: белок - 13,9 ... 37,3%, жир - 3,7 ... 10,7, клетчатка - 6,2 ... 11,3, аминокислоты: лизин, метионин, цистин, триптофан, безазотистые экстрактивные вещества (МАР), а также витамины А, D, Е, витамины группы В, в частности фолиевая кислота (Вс), биотин (Н), каротиноиды. С макроэлементов - кальций, фосфор, азот и микроэлементы: железо, цинк, марганец, медь. В биошари, что образуется в слое фильтрационного загрузки, при стечении стоков в землю, органические вещества разлагаются под

воздействием микроорганизмов. Этот механизм подобен процессу компостирования скошенной растительности, бытовых пищевых отходов и тому подобное. В то же время в последние годы наблюдается истощение почв на основные питательные элементы в результате дефицита традиционных органических и дороговизны минеральных удобрений. Частично недостаток основных питательных веществ, микроэлементов и органических веществ в почве возможно пополнить за счет удобрительных поливов выбросов спиртового производства. При этом благодаря большим поливным нормам удобрения приобретает влагозарядковый характера, позволяет обеспечить растения необходимой влагой, особенно в начальные стадии органогенеза. Актуальной эта возможность стала в последние годы, когда наблюдается довольно неустойчивое увлажнение за счет недостатка осадков в весенний период. Для уменьшения негативного воздействия на окружающую среду выбросов спиртового производства, а именно послеспиртовой барды, предлагается бардяний осадок использовать как альтернативное удобрение под сельскохозяйственные культуры.

Ключевые слова: *почва, гумус почвы, удобрения, барда, питательные вещества*

Annotation

Glovyn N., Pavliv O., Kravchenko V.

Dreg as an alternative organic fertilizer for soil

The article explores the problem of the possibility of using dreg as an alternative spreading of organic fertilizer into agricultural land. One of the reasons for the dehumidification and deterioration of agronomic properties of agricultural land is the uncontrolled application of mineral fertilizers. Only a scientific agro-ecological approach, namely the calculation of nutrient and humus balance depending on the crop grown, as well as the physical, chemical and biological characteristics of the soil, will support the level of nutrients in agricultural soils. Spreading the dreg as an organic fertilizer business owners increase the elements of nitrogen soil, which is of scientific and practical interest for agrochemistry, provides nitrogen transformation in the system "soil - fertilizer - plant" in order to increase the productivity of high quality crops in biological terms. Scientists in the field conduct systematic research aimed at developing resource- and energy-saving technologies for alcohol production and reducing the impact of harmful waste on the environment. In particular, utilization of dreg and increasing of greening of production. Conducted research and analysis of the chemical composition and emission properties of alcohol production of SC "Kozliv distillery" in order to establish their suitability for fertilizing irrigation of crops. Grain dreg mainly falls on filtration fields, which has a negative impact on the environment and pollutes agricultural land. Dreg is a non-uniform liquid with crushed particles of grain, light brown or yellow with the smell of grain or other raw material. Its active acidity (pH) is 3.8… 4.6. According to various literary data, the solids content of the dreg from different raw materials is about 10%. In terms of dry matter, it contains: protein - 13.9… 37.3%, fat - 3.7… 10.7, fiber - 6.2… 11.3, amino acids: lysine,

methionine, cystine, tryptophan, non-nitrogenous extractives (BER), as well as vitamins A, D, E, B vitamins, in particular folic acid (Bc), biotin (H), carotenoids. Of the macronutrients are calcium, phosphorus, nitrogen and trace elements: iron, zinc, manganese, and copper. In the biolayer formed in the filtration layer, the organic matter decomposes under the influence of microorganisms upon runoff into the ground. This mechanism is similar to the process of composting mowed vegetation, household food waste and the like. At the same time, in recent years there has been a depletion of soils into the main nutrients due to the scarcity of traditional organic and expensive mineral fertilizers. Partially the lack of basic nutrients, trace elements and organic matter in the soil can be replenished by fertilizing irrigation emissions from alcohol production. At the same time, due to the large irrigation standards, the fertilizer becomes moisture-charging in nature, which allows to provide the plants with the necessary moisture, especially in the initial stages of organogenesis. This opportunity has become relevant in recent years, when there is a rather unstable moisture due to lack of rainfall in the spring. To reduce the negative environmental impact of alcohol production, namely dreg, it is proposed to use dreg sediment as an alternative fertilizer for crops.

***Keywords**: soil, dehumidification, fertilizers, dreg, nutrients*

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ФОРМУВАННЯ ПРОДУКТИВНОСТІ НАСАДЖЕНЬ ЯБЛОНИ ЗАЛЕЖНО ВІД СПОСОБУ І СТРОКУ ОБРІЗУВАННЯ

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В статті викладено результати впливу строків і способів обрізування на формування продуктивності яблуні сортів Голден Делішес і Джонавелд. Доведено, що в зрошуваному саду на підщепі М.9 контурне обрізування з ручною доробкою сприяє збільшенню на 15% кількості зав'язі, на 13% рівня зав'язування і на 19% кількості плодів.

***Ключові слова:** контурне обрізування, ранньолітнє обрізування, формування продуктивності, яблуня.*