

# **РЕЗЮМЕТА**

## **на научните трудове на доц. дн Гергана Костадинова, след хабилитация за „Доцент“**

### **I. ДИСЕРТАЦИЯ ЗА ДОКТОР НА НАУКИТЕ**

**Костадинова, Г. (2015). Оценка на качеството на природни и отпадъчни води, използвани в агроекосистеми. Дисертация за ДН, Аграрен факултет при Тракийски университет, Стара Загора, 357 стр.**

**Резюме:** В съответствие с новите подходи и изисквания към управлението на водите, заложи в РДВ 2000/60/ЕС, е направено проучване и оценка на качеството на природни (повърхностни и подземни) води от различни водни тела (4 реки, 3 езера, 13 кладенци) и на отпадъчни води от пречиствателни станции в населени места (2 бр.) и животновъдни обекти (1 бр.) в Източноромански район за управление на водите, по действащата нормативна уредба, като природен ресурс (повърхностни и подземни води), като ресурс за напояване на земеделски култури (повърхностни и отпадъчни води) и като ресурс за поене на селскостопански животни (повърхностни и подземни води).

Проучването на водите по органолептични - (подземни води), физикохимични и микробиологични (повърхностни, подземни и отпадъчни води) показатели даде възможност: а) да се определи тяхното качество като природен ресурс, ресурс за напояване и ресурс за поене на селскостопански животни; б) да се установят основните замърсители на различните категории води и техните източници; в) да се разкрият основни взаимовръзки и зависимости между изследваните показатели; г) да се изведат регресионни уравнения за приблизително определяне на някои замърсители във водите; д) да се определи ефективността на пречистване на отпадъчните води от ГПСОВ и от ПС към животновъдни обекти и качеството им за заустване във водоприемниците и като ресурс за напояване; е) да се обосновават изводи и препоръки за практиката; ж) да се формулират научно-приложни приноси.

### **II. НАУЧНИ ПУБЛИКАЦИИ, ИЗПОЛЗВАНИ В ДИСЕРТАЦИЯТА ЗА ДОКТОР НА НАУКИТЕ**

**1. Костадинова, Г., Г. Петков, В. Баракова (2007). Ефективност на пречистване на отпадъчните води от градската пречиствателната станция в гр. Казанлък, *Екология и Бъдеще*, год. VI, № 1, 43-50.**

**Abstract.** It was studied and evaluated the effectiveness of the wastewater purification from Kazanluk city wastewater treatment plant - WWTP (with mechanical and biochemical steps) on the base of chemical indices (BOD<sub>5</sub>, COD, permanganate oxidation and insoluble substances), included in ecological legislation of the country. It was found that: a) the wastewater of the city are most polluted in the points B and G, i.e. in the industrial zone of the city; b) WWTP works with high efficiency and purifying wastewater according the requirements of the Bulgarian ecological legislation refer to BOD<sub>5</sub> by 94.4%; COD by 90.1%, permanganate oxidation by 89.7% and insoluble substances by 71.2%; c) the purified wastewater do not pollute the water of Tundja river over the limit values for harmful substances, which characterizes the water of the river as water in II categories.

**Key words:** wastewater, wastewater treatment plant, quality, assessment, chemical indices, ecological legislation

**2. Kostadinova, G., G. Petkov, V. Barakova (2009). Efficacy of Waste Water Management Units on Pig Farm, *Journal of Balkan Ecology*, vol. 12, № 4, 379-386.**

**Abstract.** The efficacy of a waste management unit with mechanical and biological separation steps was evaluated with regard to decontamination of effluents (mixture of manure, urine and technological water) on a pig farm with capacity of 5,500 pigs using parameters included in the national ecological legislation. It was established that: a) the highest concentrations of analyzed parameters in farm effluents (BOD<sub>5</sub>, total solids, total nitrogen, total phosphorus, total fats) were measured between 8.00 and 10.00 AM compared to the other hours of the day; b) the waste management units exhibited a low efficacy of purification as followed: BOD<sub>5</sub> in 50.5% – 52.2 %; total solids in 67.9 – 68.3 %; total nitrogen in 13.9 – 16.6 %; total phosphorus in 10.1 – 10.4 % and total fats in 71.2 – 72.2 %; c) wastewater exceeded the reference quality limits for the various parameters as followed: BOD<sub>5</sub> (upper limit <400 mg/l) by 1.8 times; total solids (upper limit <200 mg/l) by 5.18 times; total nitrogen (upper limit <35 mg/l) by 7.4 times; total phosphorus (upper limit <15 mg/l) by 1.8 times. Only the content of fats was within the reference range (upper limit <120 mg/l).

**Key words:** pig farm, wastewater, waste management units, parameters, quality, ecological evaluation

## **2a. Kostadinova, G., G. Petkov, V. Barakova (2009). Investigation on the Waste Water Management Units on Pig Farm, *Krmiva*, Zagreb, № 5, 279-285.**

**Abstract.** The efficacy of a waste management unit with mechanical and biological separation steps was evaluated with regard to decontamination of effluents (mixture of manure, urine and technological water) on a pig farm with capacity of 5,500 pigs using parameters included in the national ecological legislation. It was established that: a) the highest concentrations of analyzed parameters in farm effluents (BOD<sub>5</sub>, total solids, total nitrogen, total phosphorus, total fats) were measured between 8.00 and 10.00 AM compared to the other hours of the day; b) the waste management units exhibited a low efficacy of purification as followed: BOD<sub>5</sub> in 50.5% – 52.2 %; total solids in 67.9 – 68.3 %; total nitrogen in 13.9 – 16.6 %; total phosphorus in 10.1 – 10.4 % and total fats in 71.2 – 72.2 %; c) wastewater exceeded the reference quality limits for the various parameters as followed: BOD<sub>5</sub> (upper limit <400 mg/l) by 1.8 times; total solids (upper limit <200 mg/l) by 5.18 times; total nitrogen (upper limit <35 mg/l) by 7.4 times; total phosphorus (upper limit <15 mg/l) by 1.8 times. Only the content of fats was within the reference range (upper limit <120 mg/l).

**Key words:** pig farm, wastewater, waste management units, parameters, quality, ecological evaluation

## **3. Georgieva, N., Z. Yaneva, G. Kostadinova (2011). Spatio-temporal distribution of nitrates, nitrites and ammonium in groundwaters, *ECOLOGICA*, 18, 64, 623-630.**

**Abstract.** The present research was provoked as a result of the deteriorated ecological situation in Stara Zagora Region, Bulgaria, during the last 8 years. The aim of the study was to assess the temporal concentration variations and spatial distribution of nitrogen compounds (nitrate, nitrite and ammonium) in the natural waters of Stara Zagora Region, Bulgaria, over the period of one year (December, 2009 – November, 2010). To accomplish this goal, the concentrations of nitrogen compounds in 36 groundwater samples from four municipalities in Stara Zagora Region were spectrophotometrically determined. The present study ascertained that the groundwater and drinking water quality standards for nitrates (50 mg/L) were exceeded in 50% of the sampling points, with concentrations in range 64.3 – 99.6 mg/L NO<sub>3</sub><sup>-</sup>, predominantly during the spring, 2010. The Hierarchical Cluster Analysis (HCA) exhibited divergent apportionment of nitrogen compounds in the examined groundwater bodies.

**Key words:** nitrates, nitrites, ammonium, groundwater, Hierarchical Cluster Analysis, Principal Component Analysis

## **4. Stefanova, R., G. Kostadinova, N. Georgieva (2012). Water quality assessment from own source at poultry farm located in rural region in South Bulgaria, *Agricultural Science and Technology*, vol. 4, No 2, 143-147.**

**Abstract.** The aim of the study was to investigate and assess the quality of water, obtained from own well source at a poultry farm (with capacity 13 350 hens and turkeys), situated in rural area in South

Bulgaria, on the basis of organoleptic (smell, color, visibility, taste), physical (temperature) and chemical (pH, permanganate oxidation, hardness, chlorides, ammonia, nitrates, nitrites) indices. It was found that the quality of water corresponded to the norms concerning the organoleptic (smell – 0 ball, norm up to 2 ball; color - 5°, norm up to 15°; visibility - over 60 cm thickness of water plast, norm at least 30 cm; taste - no flavor, norm no flavor), physical (temperature – 13.5-16.8 °C, norm 6-16 °C) and chemical (pH 6.80÷7.15, norm 6.5-9.5; oxidizability 0.24÷0.72 mg O<sub>2</sub>/l, norm up to 5.0 mg O<sub>2</sub>/l; hardness 6.49÷7.55 mg Σqv/l, norm up to 12.0 mg Σqv/l; chlorides 162.0÷197.0 mg/l, norm up to 250.0 mg/l and nitrites 0.0÷0.021 mg/l, norm up to 20.5 mg/l) indices. The most significant deviation from quality standards were observed regarding the concentration of ammonia (0.01÷0.6, norm up to 0.5 mg/l) and nitrates (58.0÷110.0 mg/l, norm up to 50.0 mg/l).

**Key words:** poultry farm, water, indices, assessment, quality

**5. Mihaylova, Gr., G. Kostadinova, G. Petkov (2012). Assessment of the physical-chemical status of surface water in lower part of Toundja river, Bulgaria, *Agricultural Science and Technology*, 4, (3): 277-284.**

**Abstract.** The aim of the study was to assess the physical-chemical status of surface water in lower part of Toundja river (to the border with Turkey), on selected indicators of water quality (temperature, oxygen balance, pH, conductivity, ammonium nitrogen – N-NH<sub>4</sub>, nitrite nitrogen – N-NO<sub>2</sub>, nitrate nitrogen - N-NO<sub>3</sub>, phosphates – P-PO<sub>4</sub>, BOD<sub>5</sub>) in accordance with the proposed Classification system (Consortium for Biomonitoring, 2010). The system is designed according to the Water Framework Directive (WFD) of the European Union 2000/60/EC, whose main objective is to achieve “good water status for surface water bodies by 2015”. The assessment was carried out at water body level, taking into account the results for three groups of indicators: general, nutrients and organic pollutants. For the investigated area was found a “good” ecological status for surface water bodies of semi-river type R5. Achieving the goal of “good” ecological state for surface water bodies of river type R12 (large lowland rivers) is mainly related to reducing pollution from phosphates and nitrite nitrogen. This leads to a real risk of not achieving the WFD objective of “good physical-chemical status” of surface water, used for irrigation in agriculture and for other human activities.

**Key words:** Water Framework Directive, Toundja river, river water body type, physical-chemical quality indices, water quality status assessment

**6. Georgieva, N., Z. Yaneva, G. Kostadinova (2012). Analyses and assessment of the spatial and temporal distribution of nitrogen compounds in surface waters, *Water and Environmental Journal*, 1 1-10 (IF = 0.969, 2012).**

**Abstract.** The temporal concentration variations and spatial distribution of nitrogen compounds (nitrate, nitrite, ammonium) in the natural surface waters of Stara Zagora Region, Bulgaria, over a period of 1 year were assessed in the present study. Nitrate-nitrogen concentrations in all surface water samples, except for the December value – 21.8 mg/L in Zetyovo Reservoir, were within the permissible national quality standards. NO<sub>2</sub><sup>-</sup>-N could be classified as a priority pollutant of Chirpan and Zetyovo Reservoirs waters. The greatest extent of NH<sub>4</sub><sup>+</sup>-N pollution was registered in Chirpan Reservoir surface waters. The correlation study revealed appreciable mutual relationship only between NH<sub>4</sub><sup>+</sup>-N and NO<sub>2</sub><sup>-</sup>-N in the surface waters. The hierarchical cluster analysis (HCA) exhibited divergent apportionment of nitrogen compounds in the surface water bodies

**Key words:** ammonium; hierarchical cluster analysis; nitrates; nitrites; principal component analysis; Stara Zagora Region; surface waters

**7. Kostadinova, G. N. Georgieva, Z. Yaneva, G. Petkov, M. Todorova, Ch. Miteva (2013). Tundzha river water quality as a source for irrigation in agriculture. *Bulgarian Journal of Agricultural Science*, vol. 19, 4, 635-643, (IF=0.136, 2012).**

**Abstract.** The aim of the study was to investigate the quality of Tundzha River water in the upper stream during the summer of 2010 by 25 physicochemical indices, and assessed their suitability for irrigation in agriculture. For sampling and sample preparation of water, international ISO and BSS references were used. Sample analyses were made by equipment Mrlti 340i/SET, spectrophotometric methods and AAS. It was established that the quality of the surface water corresponded to the standards for irrigation according to 23 indices: temperature, pH, conductivity, total hardness, Ca, Mg, dissolved oxygen, BOD<sub>5</sub>, COD, ammonium (NH<sub>4</sub><sup>+</sup>), nitrites (NO<sub>2</sub><sup>-</sup>), nitrates (NO<sub>3</sub><sup>-</sup>), chlorides (Cl<sup>-</sup>), sulfates (SO<sub>4</sub><sup>2-</sup>), phosphates (PO<sub>4</sub><sup>3-</sup>), K, Fe, Ni, Cu, Zn, Pb, Cd and Cr(VI). Deviations from the regulated standards were established for suspended solids and Mn. The correlation matrix revealed appreciable mutual relationship: between suspended solids-dissolved oxygen, conductivity-BOD, total hardness-BOD and total hardness-conductivity (R<sup>2</sup> 0.957 - 0.999), and between Mg-Ca; K-Ca; Mn-Ca; Mn-Mg; Mn-K; Ni-K; Ni-Zn; Cd-Ca; Cd-Mg; Cd-K; Cd-Mn and Cd-Ni (R<sup>2</sup> 0.951 - 0.999) in the studied water samples. Data analysis revealed that the anthropogenic impact on Tundzha River water in the investigated area does not affect water quality with a view to its applicability for irrigation purposes. The registered deviations from the quality standard for Mn could be explained by the discharge of industrial and sewage wastewaters from Kazanlak City (46545 inhabitants, large industrial center).

**Key words:** water quality, indices, assessment, irrigation

**8. Kostadinova, G. (2013). Sanitary hygienic assessment of drinking water from underground source at a pig farm, *Agricultural Science and Technology*, vol. 5, No 4, 448-454.**

**Abstract.** The aim of the study was to investigate and assess the quality of drinking water, obtained from own well source at a pig farm (with an average daily number of reared pigs 532 units), situated in South Bulgaria, Plovdiv Municipality, on the base of main organoleptic, physical, chemical and microbiological indices. For this purpose once a month (from July 2009 to March 2010.) water samples were collected and analyzed by reference methods of Bulgarian State Standard. It was found that the quality of water correspond to the norms concerning organoleptic indices (smell – State 0, norm up to State 2; color – 5°color degrees, norm up to 15°color degrees; visibility – over 65 cm thickness of the water plast through that should clearly see text with a special typeface, norm at least 30 cm; taste – no flavor, norm no flavor), chemical indices (pH 7.45÷7.75, norm 6.5–9.5; oxidizability 0.72÷2.16 mg O<sub>2</sub>/L, norm up to 5.0 mg O<sub>2</sub>/L; total hardness 2.82÷4.45 mg Σqv/L, norm up to 12.0 mg Σqv/L; content of chlorides 20.3÷36.0 mg/l, norm up to 250.0 mg/L, ammonia – not proved, norm up to 0.50 mg/L, nitrites 0.007-0.094 mg/L, norm up to 0.50 mg/L, and nitrates 3.0÷25.0 mg/L, norm up to 50.0 mg/L) and total number of cultivable microorganisms (5 -18 CFU/mL), norm - without significant variability of the index value of the investigated water. The only exception was found for the water temperature, whose maximum values exceeded the requirements of the standard (16 °C) and number of *Escherichia coli* (Coliform's test), which values were higher than norm (0 CFU/100 mL), for both indices during five months from the studied period. The deviation in the quality of water in respect content of *E. coli* suggests anthropogenic pollution on groundwater of the own well with coliform bacteria, containing in manure and urine from the pigs in the farm. Organoleptic, chemical and microbiological characteristics of the sampled water meet the requirements of the Dutch standard for drinking water for pigs. This standard allows higher level of oxygenation of the water and higher levels of ammonium and nitrate content in water compared to Bulgarian standard for humans and animals drinking water. Perhaps time has come, as in the Netherlands to develop a national standard for drinking water, which be applied only to farm animals.

**Key words:** pig farm, water, indices, assessment, quality

**9. Костадинова, Г. (2014). Екологична и агроекологична оценка на води от язовири в община Чирпан, *Екология и Бъдеще*, год. 13, № 1-2, 40-49.**

**Abstract.** The objective of this study was to investigate and assess the quality of water from three dams (Chirpan, Zetiyovo and Malak Urt), situated in Chirpan Municipality (South-Central region of Bulgaria), by 26 physicochemical indices for one year period. For sampling and sample preparation of water, international references of ISO and BSS were used. Sample analyses were made by equipment Mrlti 340i/SET, spectrometric methods and AAS. It was found that: 1) entry summary ecological assessment determined the quality of surface water from the three water bodies in class “*worse than a moderate*”; 2) the content of Fe (except “Chirpan” and “Malak Yurt” dams), Mn, Cu, Zn and Cr(VI) in the water do not meet the standard for surface water quality; 3) water quality of all dams meets the legal requirements for irrigation of agricultural crops by electrical conductivity, pH, COD, BOD<sub>5</sub>, dissolved oxygen, total hardness, N-NH<sub>4</sub>, N-NO<sub>3</sub>, Ca, Mg, K, Fe, Cu, Pb, Ni, Cd и Cr(VI), and deviates from the norms for temperature, unsuspended solids, Mn, Zn, SO<sub>4</sub>, PO<sub>4</sub>; 4) water quality meet the requirements for standard of drinking water for livestock for electrical conductivity, pH, total hardness, N-NO<sub>3</sub>, Cl<sup>-</sup>, Ca, Mg, Fe, Cu, Zn, Pb, Ni and Cr(VI), and deviates from the norms for oxidizability, N-NH<sub>4</sub>, N-NO<sub>2</sub>, P-PO<sub>4</sub>, Mn and Ni content.

**Key words:** dams, water, indices, assessment, quality

#### **10. Kostadinova, G. (2014). Assessment of Underground Water Quality from Wells Used for Irrigation and Livestock, *Journal of Balkan Ecology*, vol. 17, No 2, 181-194.**

**Abstract.** The paper deals with assessment of the quality of underground water as a natural resource and as source for irrigation and for livestock breeding from drilled wells, situated in different villages (Sheinovo, Cherganovo and Rajena) in the territory of Kazanluk Municipality, south-central region of Bulgaria. We measured 20 physical and chemical indices for one year. For sampling and sample preparation of water, international references of ISO and BSS were used. Sample analyses were made by equipment Mrlti 340i/SET, spectrometric methods and AAS. It was established that the quality of water in three wells: First: does not meet the quality standard for underground water as a natural resource for content of N-NO<sub>3</sub>, PO<sub>4</sub> and Zn according to Regulation No 1/2007 for study, use and protection of groundwater. The water is in *bad ecological status*. Second: meets the quality standard for irrigation of agricultural crops by indices: temperature, electrical conductivity, pH, total hardness and contents of Ca, Mg, N-NH<sub>4</sub>, SO<sub>4</sub>, Mn, Fe, Cu, Zn, Pb, Ni and Cd, and deviates from the standard by content of N-NO<sub>3</sub> and PO<sub>4</sub>. Under certain conditions, stipulated in Regulation No 18/2009, water from the investigated wells can be used for irrigation. Third: meets the quality standard for drinking water according to Regulation No 9/2001 for humans and livestock by indices: electrical conductivity, pH, permanganate oxidation, total hardness and content of Ca, Mg, N-NH<sub>4</sub>, N-NO<sub>2</sub>, N-NO<sub>3</sub>, SO<sub>4</sub><sup>2-</sup>, Cl<sup>-</sup>, Mn, Fe, Cu, Zn, Pb, Ni and Cd, and deviates from the standard by content of PO<sub>4</sub>.

**Key words:** pollution, drilled well, underground water, physical and chemical index, water quality

#### **11. Kostadinova, G., D. Dermendjieva, G. Petkov, J. Gotchev (2014). Agroecological assessment of wastewater and sludge from Municipal Wastewater Treatment Plant by content nutrient inputs, *Agricultural Science and Technology*, 6 (3): 325-332.**

**Abstract.** The purpose of this study was to investigate and assess the quality of wastewater and sludge from different monitoring points (4 for wastewater and 3 for sludge) in Municipal Wastewater Treatment Plant, Stara Zagora, Bulgaria, for the period July 2013 – March 2014, by content of nutrient inputs (total N, total P and total K), absolutely dry matter, pH and electrical conductivity, in order to determine opportunities for their use in agriculture. For sampling and sample preparation of wastewater and sludge, international references of ISO and BSS were used. Sample analyses were made by equipment as follows: pH-meter Lab 850 (pH), Multi 340i/SET (electrical conductivity), method of Kjeldahl (total N), spectrophotometer UV/VIS 6705 JENWAY (total P) and AAC „AAnalyst 800”–Perkin Elmer (total K). It was found that: 1) Treated wastewater has neutral pH, low electrical conductivity and low total K content, as well as lower content of total N and total P than the maximum allowed concentrations for their discharge into the receiving water body – Bedechka river, defined from

ecological point of view as a sensitive water body; 2) The effect of wastewater treatment in respect of total N was 87.4%, total P – 97.8% and total K – 23.0%, respectively; 3) Treated wastewater meets the requirements for irrigation of crops by indices: pH, electrical conductivity and content of total N, total P and total K; 4) The sludge has typical content of absolutely dry matter, neutral pH and high values of electrical conductivity, as well as lower content of total N (from 1.3 to 3.2 times), total P (from 3.2 to 7.8 times) and total K (from 4.4 to 12.2 times) in comparison with the sludge from 9 other WWTPs in the country, which is result of the modern technology of sludge treatment in WWTP-Stara Zagora; 5) Sludge contains more total N (from 2.71 to 7.5 times), comparable amount of total P and less quantity of total K compared with livestock manure.

**Key words:** Municipal Wastewater Treatment Plant, wastewater, sludge, nutrient inputs, assessment

**12. Костадинова, Г., Д. Дерменджиева, Е. Валкова, Г. Беев, Т. Пенев, Я. Миков (2015). Качество на водите от собствени водоизточници в говедовъдна и овцевъдна ферма, Животновъдни науки, 52 (1): 41-54.**

**Abstract.** The aim of this paper was to study and assess the quality of water obtained from own drilled wells in cattle and sheep farms, situated in an area with strong anthropogenic impact, as a natural resource and as a resource for the watering of animals, on basic organoleptic, physico-chemical and microbiological indices. It was found that the quality of water: a) as a natural resource, is defined in “good” ecological status in terms of the studied physico-chemical parameters: pH, conductivity, total hardness, Ca, Mg, oxidizability,  $\text{NH}_4^+$ ,  $\text{NO}_2^-$ ,  $\text{NO}_3^-$ ,  $\text{SO}_4^{2-}$ ,  $\text{PO}_4^{3-}$ ,  $\text{Cl}^-$ , Mn, Fe, Zn, Pb and Cd; b) meets the stipulated norms for the watering of livestock on all organoleptic (taste, smell, transparency, color) and on part of the physico-chemical (pH, conductivity, total hardness, Ca, Mg, Mn,  $\text{SO}_4^{2-}$ ,  $\text{Cl}^-$ , Mn, Fe, Zn, Pb and Cd), and sanitary-hygiene (total number of microorganisms in water of well in cattle farm) indicators; c) does not match the quality standard for water for drinking purposes on content of  $\text{NH}_4^+$  and  $\text{PO}_4^{3-}$  in water of well at cattle farm; on content of  $\text{NH}_4^+$ ,  $\text{NO}_2^-$ ,  $\text{NO}_3^-$ ,  $\text{PO}_4^{3-}$  and total number of microorganisms in water of well at sheep farm; on values of number of coliforms in the water of wells at two farms; d) assessed on simultaneously presence of nitrates and nitrites in water, satisfies regulatory requirements ( $\text{C} \leq 1 \text{ mg/l}$ ) for water of well at cattle farms throughout the studied period, and for water of well at sheep farm - in 3 of the 5 months of the experimental period.

**Key words:** cattle and sheep farm, well, water, indices, quality, assessment

### **III. НАУЧНИ ПУБЛИКАЦИИ, СЛЕД ПЪРВА ХАБИЛИТАЦИЯ, ИЗВЪН ДИСЕРТАЦИЯТА ЗА ДОКТОР НА НАУКИТЕ**

**1. Петков, Г., В. Баракова, Ю. Митев, Г. Костадинова (2008). Устойчиво развитие на агроекосистемите, В Пленарен доклад от Национална научна конференция с международно участие, на тема: „Устойчиво аграрно развитие на България в Европейския съюз”, 6-9 май 2008 г., Тракийски университет, Стара Загора, 14-25.**

**Резюме.** Направена е характеристика и класифициране на агроекосистемите, според факторите, които влияят върху тяхното формиране и функциониране. Детерминирани и анализирани са основните ресурси, които се използват в една агроекосистема – природни, човешки, капиталови, продуктови. Разработен е SWOT анализ за силните и слаби страни, възможностите и заплахите за развитието на селските райони в България. Посочени са приоритетите в политиката, целите и пътищата на ЕС и на страната за устойчиво развитие на агроекосистемите. Изтъкната е ролята на обучението на фермери, инвеститори и специалисти в областта на земеделието по създаване, управление и експлоатация на устойчиви агроекосистеми.

**Ключови думи:** агроекосистеми, SWOT анализ, политика, законодателство, устойчиво развитие

**2. Petkov, G., G. Kostadinova, V. Barakova, R. Stefanova (2009). Environmental pollution from dairy and pig farms in Bulgaria, Proceedings form IV Balkan Conference on Animal Science “BALNIMALCON – 2009” – “Challenges of the Balkan Animal Industry and the Role of Science and Cooperation”, 14-16 May 2009, Trakia University, Faculty of Agriculture, Stara Zagora, Bulgaria, 453-457.**

**Abstract.** It was analyzed the ecological problems in small dairy (10 and 40 cows capacity) and pig (30 and 90 sows capacity) farms on the base of the data of our own research and literature sources. The ecological problems from the new created farms in the country are complicated, because many of these structures are situated in the villages and most of them are not considered with the new ecological legislation. It was established that: a) *Air*: Emissions from the buildings in both kind of investigated farms are highest in the morning (7.00-9.00 h), comparatively by middle of the day (13.00-5.00 h) and in the evening (17.00-19.00 h). Exists a high reliable correlation (at  $P < 0.0000$ ) between the level of air pollution with  $\text{NH}_3$ ,  $\text{H}_2\text{S}$ , dust and total number of microorganisms (TNM) surround the buildings and the distance from them; b) *Water*: The organoleptic (odour, color, taste, limpidity), physical (temperature) and chemical (pH, oxidation, hardness, ammonia, nitrites, nitrates, chlorides) parameters of the water are in the norms. Risk for the water quality is the TNM and coli-titer; c) *Soil*: The manure, storied on the ground is source for soil pollution up to 30 m distance surrounds these places. The main pollutions are phosphorous, potassium, TNM and coli forms, which determined the soil between the next two categories – from comparatively pure to polluted soil

**Key words:** dairy and pig farms, pollution, indices, air, water, soil, assessment

**3. Стефанова, Р., Г. Костадинова, В. Баракова (2009). Проучване и оценка на замърсяването на въздуха при отглеждане на птици. Int. Science conference 4-5 June 2009 Stara Zagora, Nautical & Environmental Studies, 118-122.**

**Abstract.** The pollutant substances of the atmospheric air retained from farm where are reared turkeys (building A) and hens (building B) were investigated. The farm is situated at Malko Kadievo village, Stara Zagora municipality. The study was carried out for the period September, 2008 – March, 2009. Turkeys and hens are reared on the depth litter bedding and the buildings have natural ventilation systems. Air quality was assessed by measuring concentrations of total dust, ammonia ( $\text{NH}_3$ ) and hydrogen sulfide ( $\text{H}_2\text{S}$ ) in the monitoring points (MPs) situated in building for turkeys (MP-1A) and in building for hens (MP-1B), and at different distances from buildings as follow: at 2 m (MP-2), at 20 m (MP-3) and at 50 m (MP-4) leeward, and at 50 m (MP-5) windward of the farm. It was found that dust concentrations are higher than norm (above norm) in 92.2% of all samples in MPs situated at 2 m distance from building A and in 100% of the samples at 2 m distance from building B. All measured ammonia levels in the air at 2 m distance are higher than norms ( $0.25 \text{ mg/m}^3$ ) with levels of  $12.18 \text{ mg/m}^3$  for the building A. In the building B the concentration varied from  $1.31 \text{ mg/m}^3$  to  $14.62 \text{ mg/m}^3$ .  $\text{H}_2\text{S}$  concentrations in MPs outside of the building (ambient air) are lower than limit value (under  $0.005 \text{ mg/m}^3$ ).

**Key words:** poultry farm, air, pollution, dust,  $\text{NH}_3$ ,  $\text{H}_2\text{S}$ , assessment

**4. Petkov, G., G. Kostadinova, R. Stefanova, T. Penev, P. Gercheva (2010). Animal hygiene and ecological assessment of air pollution in a pig-farm. Agricultural Science and Technology, vol.2, No 3, 143-152.**

**Abstract.** The aim of this study was to determine air pollution with ammonia ( $\text{NH}_3$ ), hydrogen sulfide ( $\text{H}_2\text{S}$ ), total dust, microorganisms (saprophytic and coliform bacteria, including *Escherichia coli*) from a pig farm for 50 sows (average daily capacity - 532 pigs from different categories). The pollutants were measured in five monitoring points (MPs) as follows: emissions from production buildings - Point 1 ( $P_1$ ) - building for farrowing sows and Point 2 ( $P_2$ ) - building for fattening pigs; imissions in ambient air - Point 3 ( $P_3$ ) - at 2 m, and Point 4 ( $P_4$ ) - at 50 m distance from the buildings under the wind side position,

and Point 5 (P<sub>5</sub>) - at 10 m distance - over the wind side position of the farm. The levels of the hydrogen sulfide (3.31-7.10 mg.m<sup>-3</sup>), total dust (0.71-5.11 mg.m<sup>-3</sup>) and number of cultivable microorganisms (13,0 x 10<sup>3</sup> - 428,0 x 10<sup>3</sup>/m<sup>-3</sup>) in the air of the buildings (P<sub>1</sub> and P<sub>2</sub>) were within the animal hygiene requirements, except the ammonia (3.32-15.82 mg.m<sup>-3</sup>) which concentrations exceeded the norm. The air quality for the staff as a factor of working environment in the buildings covered all requirements. Emissions of NH<sub>3</sub>, H<sub>2</sub>S, total dust and microorganisms from the farm buildings maintain measurable concentrations of these pollutants (imission) at 50 m leeward and at 10 m over wind side of the farm. With increasing the distance from the production buildings contents of NH<sub>3</sub>, H<sub>2</sub>S, dust and microorganisms in the air decreased from 1.4 to 13.7 times at P<sub>4</sub> and from 1.4 to 16.7 times at P<sub>5</sub>. The air quality around the pig farm did not correspond with the norms at P<sub>4</sub>, and at P<sub>5</sub>, regarding the content of ammonia and total dust. For the content of hydrogen sulfide that finding applies to P<sub>3</sub> and P<sub>5</sub>. Statistical differences (P < 0.05 – 0.001) were established at the levels of the investigated pollutants of the air between seasons (summer, autumn, winter) in the same point and between different points at the same season.

**Key words:** pig-farm, air, pollution, assessment

**5. Петков, Г., Ц. Яблански, М. Тодорова, Д. Павлов, Г. Костадинова, В. Баракова (2010). Екологична оценка на почви от паркове и местности в гр. Стара Загора, *Екология и Бъдеще*, 9, No 4, 24-32.**

**Abstract.** The study was carried out under Project “Assessment, reduction and prevention of air, water and soil pollution in Stara Zagora region”, № 2008/115236, funded by the Norwegian Cooperation Programme with Bulgaria - Norway Grants and Innovation Norway. The study covers research and evaluation of soil quality in parks and places in the town of Stara Zagora, on the base of heavy metals and metalloids content. It was found that: a) The contents of the studied parameters were within limits as follows: deluvial-meadow soil type (parks): pH 7.23 – 8.21; content (mg/kg): Fe 13024.0 - 31103.0, Mn 585.0 - 853.0, Cr 16.9 - 29.9, Cu 43.2 – 105.0, Zn 73.1 – 224.1, Pb 18.3 – 82.5, Cd 0.074 – 0.388; cinnamon-forest soil type: pH 7.96 – 8.01; content (mg/kg): Fe 20454.0 – 22970.0, Mn 794.0 – 801.0, Cr 33.3 - 38.9, Cu 222.2 - 384.9, Zn 117.1 – 128.3, Pb 33.8 – 35.2, Cd 0.07 – 0.248; b) Ecological assessment of soil from the study objects shows that the content of Cr, Cu, Zn, Pb and Cd do not exceed the maximum permissible concentration (MPC) for different elements. The only exception is the content of Cu, which at one object exceeds 1.28 times MPC. The content of Cu, Zn and Pb exceed the corresponding precautionary concentrations (PC) (Coefficient of technogenic – Kt > 1) in three of the seven studied objects and corresponding background concentration (BC) (Coefficient of abnormality – Ca > 1) in all studied objects. Data for Kt and Ka show existing technogenic load of soil in the study objects without risk to soil ecosystems, the environment and human health. The content of Cr and Cd in soil is within the background concentrations. The content of Mn and Fe in soil is typical of soils in Bulgaria. In the parks next to streets with heavy traffic, content of Pb in soil is higher than other studied objects.

**Key words:** soil, heavy metals, metalloids, ecological assessment

**6. Bivolarski, B., G. Beev, S. Denev, E. Vachkova, G. Kostadinova, T. Slavov (2011). Development of the caecal microbiota in rabbits weaned at different age, *Agricultural Science and Technology*, vol.3, No 3, 212-219.**

**Abstract.** The experiment was conducted to study the post-natal development of the caecal microbiota in rabbits weaned at different age. A total of 60 healthy New Zealand White rabbits of both sexes, born the same day, were used in the experiment (after controlling for the effect of litter origin and weaning weight and variability). Rabbits were weaned both at 21 days (W21 group, 30 litters) and at 35 days (W35 group, 30 litters) of age. The weaned animals were randomly housed in wire net cages measuring in well-controlled experimental facility. They received standard commercial pelleted diet without antibiotics. Feed and drinking water were available *ad libitum*. Results of the microbiological

examination of the caecal contents indicated that rabbits weaned at 35 day had higher total bacterial count (TBC) per g of caecal content, in comparison with rabbits weaned at 21 day ( $P < 0.001$ ). The TBC in the caecum of earlier and later weaned rabbits after weaning increased significantly ( $P < 0.001$ ). The obligate anaerobic bacteria, particularly *Bacteroides spp.* constitute an important group of microorganisms in the rabbit caecum. The population of *Bacteroides spp.* increased with advancing of age. The differences between groups on days 35, 42 and 49 were statistically significant ( $P < 0.001$ ). Sporulating bacteria and especially *Cl. perfringens* was present in low variable amounts in all the caecal samples obtained from healthy animals. Caecal counts of *Cl. perfringens* at weaning (21 and 35 day) were very low (1.656 and 1.654 log<sub>10</sub> CFU/g, respectively) and not affected by weaning age. To the end of the study, earlier weaned rabbits had higher caecal count of *Cl. perfringens* ( $P < 0.01$ ). *Enterococcus spp.* and coliforms, including *E.coli* are an important part of the caecal microbial population of rabbits. The caecal number of coliforms was considerably high at weaning, then decreased linearly and stabilized on low level at day 49. Our study demonstrated the absence of *Lactobacillus spp.* in the rabbit caecal tract. The pH of the caecal content fell linearly throughout the experiment - there are not significant differences between groups at days 21 and 49. Compared to the W21 group, rabbits in the W35 group, had a higher live body weight ( $P < 0.001$ ) and low mortality during the trial.

**Key words:** rabbits, caecal microbiota, weaning age

**7. Kostadinova, G., G. Petkov, D. Dermendjieva, N. Georgieva, L. Dospatliev (2011). Assessment of air pollution in Stara Zagora region, Bulgaria, *Journal of Balkan Ecology*, vol. 14, No 4, 341-355.**

**Abstract.** The contents of SO<sub>2</sub>, NO<sub>2</sub> and particulate matter (PM<sub>10</sub> and PM<sub>2.5</sub>) was studied in the atmospheric air and also the content of Mn, Cu, Pb, Fe, Zn, Ni and Cd in PM<sub>10</sub> in 5 monitoring points (out of the System of National Air Monitoring) in Stara Zagora region, Bulgaria. The levels of SO<sub>2</sub> and NO<sub>2</sub> in the air of all monitoring points were significantly lower than the hourly maximum allowed contents (MAC) for protection of human health, while the concentrations of PM<sub>10</sub> and PM<sub>2.5</sub> in most of the period of study were over than the MAC. The most polluted with PM<sub>10</sub> and PM<sub>2.5</sub> was air in two points. Main sources of air pollution with SO<sub>2</sub>, NO<sub>2</sub> and particulate matter were vehicle traffic, industrial combustion plants and homes, and unsupported in good sanitary condition streets. Concentrations of all investigated chemical elements into PM<sub>10</sub> varied widely, both for the same point and between different points. The content of Zn in all points was with highest level, followed by that of Fe, Pb, Mn, Cu, Ni and Cd. No excessive concentrations of Ni, Cd and Pb in ambient air, which elements are regulated by norms, were found. The Ni content was 5.4 times lower than the MAC, that of Cd – more than 2.2 times, and that of Pb – more than 2.6 times. Factors affecting air pollution with heavy metals and metalloids in the areas around investigated monitoring points were similar, as sources of emissions and as impact on air quality.

**Key words:** air pollution, NO<sub>2</sub>, SO<sub>2</sub>, particulate matter, heavy metals

**8. Mihailova, Gr., G. Kostadinova (2012). Macrozoobenthos Communities as Indicator for Ecological Status Assessment of Surface Water Bodies in Toundja River, Bulgaria, *Journal of Balkan Ecology*, vol. 15, No 2, 173-190.**

**Abstract.** Macrozoobenthos communities and biological metrics (biotic index, BI; total number of taxa, TN taxa; and trophic rithron feeding type index, RETI) were used as indicators for ecological status assessment of the water bodies in the lower reaches of Toundja river. Biological quality element (BQE) - macrozoobenthos and these metrics were selected in compliance with Water Framework Directive (WFD, 2000/60/EC) requirements. The obtained data on the indices were compared with standard biological values and defined reference conditions for water quality assessment of the surface water, according to proposed classification system for the ecological status (EcoS) of surface water in Bulgaria. Current research of Toundja river indicates water bodies „at risk” and the urgency of taking specific measures to improve their ecological status, which is in poor condition, and plans to protect

these bodies that are in moderately and good condition. The study area of Toundja river water basin was separated into two zones: the first zone is immediately before Sliven with low anthropogenic impact and high macrozoobenthos biodiversity, and the second one – after Sliven to the Turkey border with high anthropogenic impact and low macrozoobenthos biodiversity.

**Key words:** Water Framework Directive, biological quality elements, macrozoobenthos, biotic index, total number of taxa, trophic index RETI, ecological status

**9. Петков, Г., Г. Костадинова (2012). Опазване и подобряване на околната среда и ландшафта в селските райони. В пленарен доклад от научна конференция с международно участие, на тема: „Обща селскостопанска политика на ЕС 2020 и развитие на аграрното производство в България” (Ред. Славов, Р., Д. Павлов, Г. Михайлова, М. Панайотов, В. Радев), 10-11 Май, Тракийски университет, Стара Загора, 77-98.**

**Резюме.** Направен е анализ на Общата селскостопанска политика (ОСП) на ЕС-2020 и на политиката на страната по опазване и подобряване на околната среда и ландшафта в селските райони. Постигането на целите на ОСП на ЕС-2020 в тази област може да бъде успешно, при съблюдаване на следните принципи, подходи и действия: а) разработване на SWOT анализ за развитието на селските райони в България до 2020 г.; б) определяне на въздействието на агроecosистемите върху компонентите на околната среда (въздух, води, почви); в) повишаване устойчивостта на агроecosистемите чрез прилагане на основните екологични принципи в тяхното създаването и функциониране; г) повишаване устойчивостта на териториалната структура на земеделския ландшафт с адекватни действия и мерки.

**Ключови думи:** Общата селскостопанска политика, агроecosистеми, SWOT анализ, околна среда, устойчиво развитие

**10. Miteva, Ch., G. Kostadinova, S. Laleva, P. Slavova, Y. Staykov, V. Katsarov, V. Dimova, K. Uzunova (2012). Protoform of the modern extension service in the field of animal husbandry and veterinary medicine. III. The period after the liberation of Bulgaria (Period of national progress in agriculture), *Science & Technologies, Vol. 2, Number 5, Animal Studies & Veterinary medicine, 59-67.***

**Abstract.** The present research analyses the activities of state, public and private structures assisting the work of agriculture producers after the Liberation of Bulgaria (aka period of national progress in agriculture), and throws light on their role as a protoform of the modern extension service in the field of animal husbandry and veterinary medicine from historical point of view. For this purpose, a number of governmental documents (orders, laws, ordinances etc.), rules for organisation of agricultural schools, programmes of public organisations and unions, museum and library funds expositions relevant to the study's goal were investigated. The period of national progress in agriculture in Bulgaria is associated with the foundation of different types of agricultural schools and training courses. The organisation of agricultural experimental stations and the implementation of professional training have improved the practical skills of people engaged in farm animal rearing. The foundation of livestock husbandry unions and social movements, the educational activities related to improving the knowledge and skills of livestock producers became more pragmatic and species-specific. During that period, due to the direct transition of Bulgaria to bourgeois capitalist development, agricultural educational and administrative structures organised and institutionalised in the country were similar to those of West Europe. This way, agricultural teachers, practicing agronomists, veterinarians and zootechnicians, specialists and administrative staff hired by livestock husbandry unions became the founders and distributors of scientific and applied knowledge in the field of animal and veterinary medical sciences. The training of livestock producers in the country performed by them at that time is a kind of a protoform of the modern extension service.

**Key words:** extension service, proto-form, animal science, veterinary medicine

**11. Митева, Ч., Ж. Герговска, В. Димова, Ю. Митев, К. Узунова, Г. Костадинова, Т. Пенев (2012). Начини за подобряване охлаждането на лактиращи крави и тяхното приложение у нас, *Science & Technologies, Vol. 2, Number 5, Animal Studies & Veterinary medicine, 68-72.***

**Abstract:** In cattle practice more widely used various methods for additional cooling of the air in livestock buildings to eliminate the harmful effects of high temperatures on the dairy cows. To optimize the temperature and humidity conditions in livestock buildings in summer successfully are applying different combinations of fans and sprinklers, evaporative cooling, reducing the direct effect of solar radiation, providing a sufficient amount of cold, fresh water etc. Places to implement these cooling facilities are including both animal buildings and parlors. Gradually these practices are introducing in dairy farms in the country, mainly in larger farms and from farmers who are highly motivated to continue working in this agricultural sector.

**Key words:** additional cooling, fans, sprinklers, sprayers, dairy cows

**12. Митева, Ч., Т. Пенев, Н. Русенова, Н. Василев, М. Колева, Г. Костадинова (2012). Влияние на вида на използваната постеля в говедовъдните ферми върху броя на някои маститни патогени, *Екология и Бъдеще, vol. 11, № 3, 46-50.***

**Abstract:** Mastitis pathogens are microorganisms normally found in the environment in dairy farm. They were found in bedding, feed and manure. The purpose of this study was to investigate the influence of the type of material used for bedding in three dairy farms on the growth of certain microorganisms such as coliforms (*E. coli* and *Klebsiella spp.*), staphylococci and streptococci. The use of organic materials to deep bedding is an environment in which can be found coliforms, microorganisms of the genus *Streptococcus* and genus *Staphylococcus*, and provides the necessary conditions for their rapid multiplication. Using bedding of rice husk results in a rapid and strong increase in the number of coliforms, while the number of staphylococci and streptococci increased slightly. When using the straw bedding the increase in the number of coliforms and staphylococci marked continuous increasing while the number of streptococci staying for a while and decreasing after that.

**Key words:** straw, rice hulls, mastitis pathogens, dairy farms

**13. Atanasov, V., E. Valkova, G. Kostadinova, G. Petkov, N. Georgieva, Ts. Yablanski, G. Nikolov (2012). Study on levels of some heavy metals in water and liver of carp (*Cyprinus carpio L.*) from waterbodies in Stara Zagora region, Bulgaria, *Agricultural Science and Technology, vol. 4, No 3, 321-327.***

**Abstract.** The concentrations of 8 elements (Fe, Mn, Cu, Cr, Ni, Zn, Pb and Cd) were determined in the water and liver by common carp (*Cyprinus carpio L.*) from 6 waterbodies in Stara Zagora region using atomic absorption spectrometry. Despite having a reputation for being heavily polluted, the investigated waters were not heavily burdened with examined metals. Our results suggest that fish liver were accumulating elements in the same manner such are increasing metal concentrations in waterbodies. Heavy metals concentrations were highest in the water and carp liver from Zagorka Lake and Ovcharitsa Dam, and especially of the Pb did exceed established quality standards for fish. Because the liver accumulates highest levels of heavy metals, it may be use as an important biological indicator for ecological monitoring of the fish inhabiting waterbodies.

**Key words:** waterbodies, carp, liver, heavy metals

**14. Dobрева Z, Kostadinova G, Petkov G, Stanilova S., Popov B. (2012). Determination of IgG, IgA and IgM immune complexes in plasma of adolescents from cities of Stara**

**Zagora region with different level of air pollution. *Trakia Journal of Science*, vol.10, (supplement), 195-202.**

**Abstract.** Current study was designed to investigate immune parameters in blood plasma of adolescent persons chronically exposed to different degree of ambient air pollution. IgG, IgA and IgM circulating immune complexes (IC) were chosen as parameters of humoral immune response. The peripheral venous blood was taken from adolescents living in Stara Zagora, Kazanlak, Chirpan, Radnevo and Galabovo. The quantity of IgGIC, IgAIC and IgMIC in plasma samples was determinate by CIF-ELISA. The significantly higher mean values of IgAIC were observed in students from Stara Zagora compared to students from other cities. Moreover, adolescents living in Stara Zagora showed significantly higher quantity of IgGIC than students from Radnevo and Galabovo. Adolescents living in Chirpan showed the highest quantity of IgMIC followed by students from Stara Zagora. The relatively highest concentration of PM<sub>10</sub> and PM<sub>2.5</sub>, SO<sub>2</sub> and NO<sub>2</sub> were measured in Stara Zagora. PM<sub>10</sub> concentration exceeded the limit value in 50% of all samples from Chirpan and in 40% of samples from Stara Zagora. The level of PM<sub>2.5</sub> was over the limit in 57.1% of samples from Stara Zagora, followed by Chirpan (28.6%). We concluded that air pollutants modulate humoral immune response activity in adolescents from the region investigated.

**Key words:** air pollution, IgG, IgA, IgM, immune complexes

**15. Kostadinova, G., G. Petkov (2012). Sustainable Development of Agroecosystems and Environmental Protection in Bulgaria. In: Proceeding of International Conference Ecology – Interdisciplinary science and practice, 25-26 October, 2012, Sofia, Part I, PublishScieSet-Eco-Publisher, pp. 310-317.**

**Abstract.** Analyzed the possibilities of achieving goals of the Common Agricultural Policy (CAP) of the EU, the so-called “Plan 2020”, relating to the protection and improvement of environment and rural landscapes in the country. These goals can be successfully completed if have been achieve sustainable development of agroecosystems, which are major production units in agriculture. In this context, they are characterized the factors which determine the creation and development of sustainable agriculture as follows: a) It was carried out an assessment of ecological status of rural areas in the country (SWOT analysis) as a starting point for develop adequate measures to achieve sustainable development of agroecosystems; b) It is clarified the specificity of agroecosystems as production units in agriculture; c) It is certainly the impact of agroecosystems on the environment - air (NH<sub>3</sub>, volatile organic compounds, CH<sub>4</sub>, N<sub>2</sub>O, NO, pesticides, dust, etc.), water (ammonium, nitrate, phosphate, pesticides) and soils (pesticides, heavy metals); d) Developed measures to improve the sustainability of the territorial structure of the agricultural landscape and for increasing the sustainability of agroecosystems (selection of appropriate land, diversification, better soil management, integrated crop and livestock production, crop rotation and proper treatment systems and soil fertilization, integrated pest management, extension of organic farming, pressure from society to impose sustainable production methods, other measures).

**Key words:** agroecosystems, SWOT analysis, sustainable development, environmental protection

**15a. Kostadinova, G., G. Petkov (2015). Sustainable Development of Agroecosystems and Environmental Protection in Bulgaria. *Journal of Balkan Ecology*, vol. 18, No 1, 25-35.**

**Abstract.** It was analyzed the possibilities of achieving goals of the Common Agricultural Policy (CAP) of the EU, the so-called Plan 2020, relating to the protection and improvement of environment and rural landscapes in the country. These goals can be successfully completed if we have to achieve sustainable development of agroecosystems: the major production units in agriculture. In this context, we have to characterize the factors, which determine the creation and development of sustainable agriculture as follows. It was carried out an assessment of ecological status of rural areas in the country (SWOT analysis) as a starting point to develop adequate measures to achieve sustainable development of agroecosystems. It was clarified the specificity of agroecosystems as production units in agriculture. It is certainly the impact of agroecosystems on the environment - air (NH<sub>3</sub>, volatile organic compounds,

CH<sub>4</sub>, N<sub>2</sub>O, NO, pesticides, dust, etc.), water (ammonium, nitrate, phosphate, pesticides) and soils (pesticides, heavy metals). It was developed measures to improve the sustainability of territorial structure of the agricultural landscape. For increasing the sustainability of agroecosystems, we selected appropriate land, diversification, better soil management, integrated crop and livestock production, crop rotation and proper treatment: fertilization, integrated pest management, extension of organic farming, pressure from society to impose sustainable production methods.

**Key words:** agroecosystem, SWOT analysis, sustainable development, environmental protection

**16. Петков, Г., Г. Костадинова, Д. Ганева (2013). Иновации в областта на екологията, опазване на екосистемите и използването на природните ресурси. В пленарен доклад на тема: „Иновации и развитие на земеделието в България” (Ред. Р. Славов и кол.), от Научна конференция с международно участие, 16-17 Май 2013 г., Аграрен факултет при Тракийски университет, Стара Загора, 127-144.**

**Резюме.** Направен е анализ на националната политиката и на прилаганите мерки за въвеждане на иновации в областта на екологията, опазването на екосистемите и използването на природните ресурси. Констатирано е, че: а) В страната липсва адекватна политика за еко-иновации, тъй като в нея не са обвързвани насоките за развитие на науката и икономиката, липсват конкретни ангажименти от страна на държавата, недостатъчна е защитата на интелектуалната собственост, механизмите за функциониране на елементите на иновационната система не са ефективни и взаимодействието между тях е на ниско равнище, много нисък е дялът средства за НИРД (едва 0.5%) от БВП, при средно за страните от ЕС – 1.5%; б) Има съществено изоставане в създаването на клъстери между фирми, научни институти, университети и други институции, като основно средство за ускоряване на процесите по разработване и внедряване на иновации в производството, в т.ч. в аграрния сектор; в) ЕС отдава голямо значение на иновациите в областта на екологията и опазването на околната среда. В политиката на ЕС еко-иновациите се определят като ключ за бъдещата конкурентоспособност на Европа. г) Въпреки изоставането в страната са създадени необходимите законодателни актове по опазване на околната среда и използване на природните ресурси, които регламентират до голяма степен параметрите на разработваните еко-иновации и еко-технологии за аграрното производство (по отношение на използването и опазването на водите, земеделските земи и почвите, по оползотворяването на органични утайки от пречиствателни станции в земеделието, други); д) Разработени, предложени са за внедряване или са внедрени редица еко-технологии в аграрния сектор, като технологии за: възстановяване на депа за отпадни продукти (пепелина) от ТЕЦ, рекултивация на нарушени и замърсени терени, отглеждане на нови алтернативни енергийни култури, оползотворяване на утайки от пречиствателни станции за отпадъчни води, съхранение и оползотворяване на течен оборски тор от ферми за различни видове и групи животни и др.; е) Назряла е необходимостта от създаване на Център по предприемачество в Аграрния факултет (Тракийския университет), който да обедини усилията по разработването и внедряването на екоиновации в аграрния сектор

**Ключови думи:** политика за иновации, еко-иновации, екосистеми, земеделие, внедряване

**17. Atanasov, V., E. Valkova, G. Kostadinova, G. Petkov, Ts. Yablanski, G. Petkov, P. Valkova, D. Dermendjieva (2013). Mn levels in water, sediment and algae from waterbodies with high anthropogenic impact. *Agricultural Science and Technology*, vol. 5, No 2, 206-211.**

**Abstract.** A survey and assessment of manganese (Mn) levels was carried out on the chain water – sediment – algae from 6 monitoring points, situated at three rivers and a dam with high anthropogenic impact in Stara Zagora region, South Bulgaria. International references of ISO and BSS for sampling and sample preparation of water, sediment and algae analysis were used. Manganese concentration in the collected samples was determined by atomic absorption spectrometry (AAS). It was found that despite the anthropogenic pressures on the studied waterbodies Mn content in water from all

investigated waterbodies does not exceed the maximum permissible concentration, according to national Regulation No 7/1986. Mn accumulates in high levels in sediment and algae from all surveyed monitored waterbodies. The highest Mn concentrations in sediment were measured in Sazliyska River (714.5 mg/kg) and Bedechka River (799.6 mg/kg). With the highest levels of Mn were distinguished algae delivered by Yagoda Village (663.8 mg/kg), Jrebchevo Dam (476.0 mg/kg) and Sazliyka River (411, 5 mg/kg). The estimated ratios between Mn concentrations in sediment and water have shown that the accumulation of this metal in the sediment is from 1407 (Jrebchevo Dam) to 15466 (Tundzha River, Banya Village) times more than in the water. By the sediment/algae ratio it is found that Mn is accumulated from 0.5 (Jrebchevo Dam) to 2.4 times (Bedechka River) more in sediment compared to algae. The data from algae/water ratio show that Mn is accumulated from 1301 (Tundzha River at Jrebchevo Dam) to 19565 (Tundzha River at Banya Village) times more in the algae compared to the water. This fact suggests the mechanism of accumulation of Mn in the sediment and algae, probably different from simple diffusion. The obtained results indicate that sediment and algae can serve as good indicators of pollution by Mn. They can also be used for purification of water from that metal.

**Key words:** water, sediment, algae, manganese, assessment

**18. Пенев, Т., И. Славеева, Ж. Герговска, Ч. Митева, Г. Костадинова (2013). Влияние на условия на отглеждане и сезона върху оценките за хигиена на вимето и задните крайници при черно-шарени крави и тяхната връзка с броя на соматичните клетки в млякото. *Екология и Бъдеще*, vol. XII, No 2, 48-56.**

**Abstract.** The study was performed in three dairy cattle farms with different production systems – free stall with straw bedding (farm 1); tie stalls with short straw-bedded beds (farm 2) and tie stalls with long straw-bedded beds (farm 3). The udder hygiene score (UHS) and hind limb hygiene score (HLHS) were evaluated on a 4-point system: score 1 corresponding to clean udder and hind limbs; score 4 – to udder/hind limbs severely polluted with manure. Both evaluations were done simultaneously at each farm during November-December and July-August. The total number of evaluated black-and-white cows at the three farms was 293. The lowest udder hygiene scores (UHS) were established in cows in free-stalls (farm 1) – 1.64, whereas at tie-stall farms scores were higher (2.14 and 2.66 for farms 3 and 2 respectively). The highest relative proportion of cows with clean udders (scores 1 and 2) were found at farm 1 – 86.4%, whereas animals with dirty udders (scores 3 and 4) were 13.6%. The lowest percentage of clean cows (scores 1 and 2) was established at farm 2 – 29.7% and those with scores 3 and 4 were 70.3%. Farms 1 and 3 (tie stalls) had similar proportions of clean (scores 1 and 2) and dirty (scores 3 and 4) hind limbs. The respective figures at farm 1 were 54.54 and 45.5%, and at farm 3 – 56.6 and 43.5%. The lowest number of cows with clean hind limbs (scores 1 and 2) – 11.8% and respectively, with dirty hind limbs (scores 3 and 4) – 88.1% were found at farm 2. The UHS and somatic cells counts (SCC) in milk were in a positive linear relationship – SCC increased together with hygiene score. The SCC of control milk samples from cows with clean udders (score 1) was 234.78 thousands/ml, for those with score 2 SCC increased to an average value of 654.51 thousands/ml and in samples from animals with scores 3 and 4 SCC were very high – 1013.82 and 1265.07 thousands/ml, respectively. No significant effect of hind limb hygiene score (HLHS) on SCC in milk was observed. Cows with HLHS 3 and 4 exhibited higher milk SCC (852.72 and 796.83 thousands/ml) compared to those with HLHS 1 and 2. The increase was however less pronounced and the tendency towards increase parallelly to scores – not as marked. During the summer, UHS and HLHS were lower, i.e. animals were cleaner, but milk SCC was higher compared to the autumn/winter period.

**Key words:** udder hygiene score, hind limb hygiene score, somatic cells, black-and-white cows

**19. Dobрева, Z., G. Kostadinova, B. Popov, G. Petkov, S. Stanilova (2013). Proinflammatory and anti-inflammatory cytokines in adolescents from Southeast Bulgarian cities with different levels of air pollution. *Toxicology and Industrial health*, June 14, 1-10, (IF=1.71, 2013).**

**Abstract.** Epidemiological studies demonstrated that the exposure of different air pollutants including particulate matter (PM) has been related to adverse effect on immune system. Current study was designed to investigate cytokines in blood plasma of adolescent persons continuously exposed to different degrees of ambient air pollutions. Tumor necrosis factor- $\alpha$  (TNF- $\alpha$ ), interleukin 6 (IL-6), IL-12p40, and IL-10 were chosen as cytokines of proinflammatory and anti-inflammatory immune response. The peripheral venous blood was taken from adolescents living in the cities of Stara Zagora region, Southeast Bulgaria, that is, in Stara Zagora, Kazanlak, and Chirpan. The quantity of cytokines in plasma samples was determined by enzyme-linked immunosorbent assay. Results demonstrated that youths living in Stara Zagora showed significantly smaller quantity of TNF- $\alpha$ , compared with adolescents from Kazanlak and Chirpan. Moreover, adolescents living in Stara Zagora showed significantly higher quantity of IL-10 than students from Kazanlak and Chirpan. Analysis of the data of air quality gives reason to assert that PM<sub>10</sub> and PM<sub>2.5</sub> have been the main atmospheric pollutants around the monitoring points. The complex air quality assessment based on these criteria determined that the highest air pollution was in the city of Stara Zagora, followed by Chirpan and the relatively unpolluted town was Kazanlak. We concluded that air pollutants, mostly PM<sub>2.5</sub>, can modulate cytokine production and can change the balance between proinflammatory TNF- $\alpha$  and anti-inflammatory IL-10 production. Increased levels of IL-10 combined with decreased level of TNF- $\alpha$  in adolescents living in Stara Zagora can serve as a biomarker for suppression of T helper 1 (Th1) cell-mediated immunity and exacerbation of Th2 humoral immune response and could be a prerequisite for the development of allergic and autoimmune diseases.

**Key words:** Air pollution, PM<sub>2.5</sub>, PM<sub>10</sub>, IL-10, TNF- $\alpha$

**20. Shindarska, Z., V. Kirov, G. Kostadinova, B. Baykov (2013). Comparative assessment of plant resources as substrates for bioslam production. *Agricultural Science and Technology*, vol. 5, No 4, 438-442.**

**Abstract.** It was made a comparative assessment of the main technological parameters of the silages of different types as a source for the production of biogas as well as it was given an assessment to the bioslam derived from them. For this purpose the following silages were studied: corn silage, sweet corn silage, forest silage and silages of straw and three types of beet (sugar beet, red beet and fodder) in a ratio of 10 : 90%. It was found that the investigated energy resources in terms of the technologically permissible parameters (dry matter, organic matter, macro and micro-elements) can be used as raw materials in the mix for biogas production. The forest silage as a general term which is specific for each forest ecosystem, due to substantial differences in the structure of the biocoenoses as well as in the soil composition, can be an alternative raw material to the energy crops for the production of biogas with dry matter content of 26.68%, organic carbon content – 39.50% and nitrogen content – 1.30%, as the ratio between them is 30.38:1 (C:N). After methane fermentation, a high rate of mineralization of organic matter is observed in all tested materials, expressed by high values in the bioslam of the main macro-elements (N, K, P, Ca and Mg). Established concentrations of the 8 toxic elements (Cu, Zn, As, Cd, Cr, Hg, Ni and Pb) in the bioslam, derived from the studied plant materials, are below the critical limit for the soil and plants.

**Key words:** silage, dry matter, macro and micro-elements, assessment, bioslam

**21. Прегъов, Г., Г. Костадинова, Б. Захаринов, Д. Дерменджиева, Б. Байков (2013). Производство на биогаз от активна утайка в пречиствателна станция за отпадни води Стара Загора, *Екологизация*, Електронно издание на НБУ-София, 37-43.**

**Резюме.** Проведените проучвания в Пречиствателната станция за отпадъчни води (ПСОВ)-Стара Загора през периода 2012-2013 г. показват висока екологична ефективност при комбиниране на аеробното пречистване на битово-фекалните води със стъпало за анаеробно разграждане на органичните съединения в активната утайка. Заложените параметри на пречистване в проекта на ПСОВ-Стара Загора се доближават до тези, получени при математическо моделиране. В периода

на изследване (който е преходен в експлоатацията на ПСОВ) се установяват резултати за степен на минерализиране до 37-39% при възможност за около 50%, което за етап на оптимизиране на биотехнологията за анаеробно разграждане на биомасата се преценява като приемлив. Ниското съдържание на сухо вещество в субстрата (3.20-3.45%), както и необходимостта от съчетаване на екологичните критерии с икономически (ефективно производство на биогаз), е основание да се търсят възможности за комбиниране на субстрати (в т.ч. и от енергийни култури) за оптимизиране на съдържанието сухо вещество до оптимума съгласно технологията (6-7%) и за постигане на степен на минерализация на субстрата около 50%.

**Ключови думи:** Пречиствателна станция за отпадъчни води, отпадъчни води, аеробно и анаеробно третиране, екологична ефективност

**22. Kostadinova, G., G. Petkov, S. Denev, Ch. Miteva, R. Stefanova, T. Penev (2014). Microbial pollution of manure, litter, air and soil in a poultry farm. *Bulgarian Journal of Agricultural Science*, vol. 20, No 1, 66-75, (IF=0.136, 2012).**

**Abstract.** Hygienic evaluation of the microbial pollution of the fresh manure, litter, air and soil based on the number of cultivable microorganisms and the number of coliform bacteria at six points in a broiler farm (indoor points: Point 1 – building A and Point 2 – building B - fresh manure, litter and air; outdoor points: Point 3 - at 2.0 m, Point 4 - at 20.0 m, Point 5 - at 50.0 m and Point 6, control - at 500 m distances from the buildings – air and soil) with capacity of 43000 broiler chickens was performed in the present study. The number of cultivable microorganisms and number of coliform bacteria in all investigated parameters varied widely, with clear differences among the various elements of the chain “fresh manure–litter–soil at 2.0 m, at 20.0 m, at 50.0 m and at 500.0 m from poultry buildings” and in the indoor and outdoor air at the same distances as at the soil. In fresh manure number of cultivable microorganisms and number of coliform bacteria was much higher than litter and especially than indoor air, and later significantly decreased in outdoor air and soil at 2.0 m from poultry buildings, and to a lower extent in air and soil at 20.0 m, at 50 m and at 500.0 m from broiler buildings. The fresh broiler manure and litter are main sources of inside and outside air and soil pollution surround broiler buildings in a poultry farm with saprophytic microorganisms including coliform bacteria, subject to sanitary control. Increasing the distance from poultry buildings, led to reducing the number of cultivable microorganisms and number of coliform bacteria in the soil and in the air. When removed from the broiler houses manure and litter are not stored on the farm territory and no surface drainage process water from the facilities, the air from the production buildings is a major source of environmental contamination with microorganisms.

**Key words:** broiler farm, microbial pollution, fresh manure, litter, soil, air

**23. Petrova D., D. Gerdzhikov, G. Kostadinova (2014). Contemporary assessment of the development of the genus *Chaetoceros* in the Bulgarian coastal waters, *Agricultural Science and Technology*, vol. 6, No 1, 91-97.**

**Abstract.** The genus *Chaetoceros Ehrenberg* of class *Bacillariophyceae* is widespread and abundant in species in the Black Sea phytoplankton. The aim of the article was to study its distribution in water and to analyzed its contemporary involvement in the formation of qualitative and quantitative composition of phytoplankton, the season dynamics of genus during the hydro-biological year and its role in the ecology of the Bulgarian Black Sea coastal water area for the period 2008 – 2010. It was found out that the highest species diversity, abundance and biomass of the genus were in the autumn and spring – a bimodal pattern of annual growth. 20 species and forms were registered of the genus *Chaetoceros*. They formed up to 1/3 of the taxonomic composition of *Diatoms* and 1/10 of all phytoplankton species. "Blooms" of representatives of the genus *Chaetoceros* in the researched period were not registered.

**Key words:** *Chaetoceros Ehrenberg*, taxonomy, Black Sea, phytoplankton, development, ecological assessment

**24. Petrova D., G. Kostadinova, D. Gerdzhirov (2014). Ecological assessment of the phytoplankton community in the Bulgarian Black Sea coastal waters, *Agricultural Science and Technology*, vol. 6, No 1, 98-103.**

**Abstract.** The purpose of this article was to study and make an ecological assessment of the phytoplankton community in the Bulgarian Black Sea coastal waters for the period 2008 – 2010. Taxonomic distribution in the phytoplankton community is traced and analyzed on the basis of 389 quantitative and qualitative seawater samples. Dominant and subdominant phytoplankton species, qualitative and quantitative monthly and seasonal dynamics of the main groups in phytoplankton have been identified as well as their importance for the ecological status of the Black Sea ecosystem. The obtained results for phytoplankton demonstrated a comparative reduction of the trophic degree of the Bulgarian coastal waters, dominating natural factors of the environment over the anthropogenic ones and the present status of “good” and “very good” of the researched coastal area, according to the explored parameters. The phytoplankton annual development is accordingly with the climatic conditions. Also three seasonal phytoplankton successions were defined throughout the year.

**Key words:** Black Sea, coastal waters, phytoplankton, taxa, ecological assessment

**25. Shindarska Z., G. Kostadinova, St. Hadjiev, A. Gencheva, B. Zaharinov, T. Popova, V. Kirov, G. Tivchev and B. Baykov (2014). Co-digestion of waste activated sludge and silaged mix of chicken litter and fodder beet. *Int.J.Curr.Microbiol.App.Sci*, 3 (3): 991-998 (IF=2.015, по ISRA за 2014).**

**Abstract.** In order to determine the yield of methane in a Co-degradation study with different substrates. The study involved the following substrates: waste-activated sludge (WAS) only; WAS+silage 2:1; WAS+silage 1:1; WAS+silage 1:2. Studied is the content of the macro and micronutrient in the tested substrates and biogas yield after methane fermentation. It was found that major disadvantage of the biochemical methane potential (BMP) test is the fact that it does not provide short-term results because of its duration, methane yield during a shorter period could be predicted by evaluating the reaction rate provided by the rate constant.

**Key words:** Co-digestion, substrate, sludge, silage, inoculum, biogas, methane

**26. Kirov, V., Z. Shindarska, G. Kostadinova, A. Gencheva, St. Hadjiev, T. Penev and B. Baykov (2014). Comparative study of new energy crops for the production of biogas, *Int.J.Curr.Microbiol.App.Sci.*, 3(11): 181-188 (IF=2.015, по ISRA за 2014).**

**Abstract.** A comparative study of new energy crops has been conducted. Its aim was to give a comparative assessment of the main technological parameters for biogas production. Samples of the following energy crops were examined: four species of Paulownia hybrid, Shan Tong, Kawakamii and Elungata, Willow, Miscanthus and Arundo. The examined energy crops have optimum values of the main technological parameters in the production of biogas/dry matter, organic matter, carbon, nitrogen and the C:N ratio.

**Key words:** Biogas, Energy plants (crops), Biogas, Methane

**27. Dospatliev, L., A. Aatanasoff, G. Kostadinova, T. Penev, Tch. Miteva, V. Kirov (2015). Factors associated with change in pH, ammonia and total nitrogen of manure mass in high performance dairy cows, *VETERINARIJA IR ZOOTECHNIKA (Vet Med Zoot)*, 70 (92):10-15. (IF=0.101, 2012).**

**Abstract.** The purpose of the present study was to monitor the changes in pH, ammonia and total nitrogen contents of manure samples obtained from three populations of dairy cows reared and fed in intensive production systems. The experiments were performed in April–May 2012 with three dairy cows' populations – A, B and C, fed 16, 17 and 18 % dietary crude protein and with 305-day milk yields of 25, 26 and 28 kg, respectively. It was established that the faecal pH of all three populations was

between 6.07 and 6.65. The urinal samples showed alkaline values (pH urine 8.47 - 8.62). When urine was mixed with faeces, the ammonia nitrogen content increased correlating with manure mass pH increase. The average manure pH in the three studied populations attained 8.62 (population A), 8.48 (population B) and 8.49 (population C). Field analyses showed increase in manure pH from the beginning towards the end of the manure alley during cleaning. For population A, the respective values were 8.44 in the beginning, 8.88 in the middle and 9.05 at the end of the manure alley. After the passage of the scraper, the pH of manure remaining on the floor was 8.75. For the second population of cows, manure pH in the three manure alley points was 8.30; 8.42 and 8.64, and pH of remaining manure was alkaline (pH=8.50). For the third population, manure pH during scraping was 8.22; 8.52 and 8.78 in the beginning, middle and end of the manure alley respectively, while that of remaining manure on the floor was 8.54. Data showed that dairy cows were in an alkaline environment due to degradation of non-utilized urea nitrogen to ammonia nitrogen.

**Key words:** pH, NH<sub>4</sub>-N, N, CP, manure mass (MM); dairy cows, total nitrogen

**28. Valkova, E., V. Atanasov, K. Velichkova, G. Kostadinova G. Petkov (2015). Content of Cd in water, sediment, aquatic plants and musculature of Carp from surface waterbodies in Stara Zagora region, Bulgaria, *Bulgarian Journal of Agricultural Science*, vol. 21, Supplement 1, 190-195. (IF=0.136 за 2012 г.).**

**Abstract.** Cd is released in considerable amounts through industrial effluents into soil, surface and ground water systems. These excessive amounts of cadmium releasing into the environment reach toxic levels and cause damage to the flora and fauna of aquatic ecosystems. This study was carried out in order to survey and assess the levels of Cd in the water, sediment, aquatic plants and carp from different surface waterbodies in Stara Zagora Region, Bulgaria. International standards of ISO and BSS for sample preparation of water, sediment, aquatic plants and musculature of carp analyze were used. Concentration of Cd in the analyzed samples was determined by atomic adsorption spectrometry. Monitoring points at which was conducted the research are located in a region with a high degree of anthropogenic impact. Despite this fact, the concentrations of cadmium in all water samples tested were well below requirements defined by Directive 2008/105/EO and Directive 2013/39/EO. The concentrations of Cd were highest in sediment samples from Bedechka River (0.33 mg.kg<sup>-1</sup>), Tunja River, Nikolaevo Town (0.31 mg.kg<sup>-1</sup>) and Sazliika River (0.26 mg.kg<sup>-1</sup>); in the aquatic plants from the Tunja River, Nikolaevo Town (1.89 mg.kg<sup>-1</sup>). Concentrations of cadmium in musculature of carp of the all studied points were significantly lower than established norms. Quantities of cadmium were not accumulated in the muscles of the fish test species probably due to their accumulation in organs with active metabolism (liver).

**Key words:** aquatic plants, assessment, cadmium, carp, musculature, sediment, water

**29. Kostadinova, G., D. Dermendzhieva, G. Petkov, I. Taneva (2015). Agroecological assessment of wastewater from Municipal Wastewater Treatment Plant by physiochemical parameters, *Agricultural Science and Technology*, vol. 7, No 2, 242-247.**

**Abstract.** The purpose of this study was to investigate and assess the quality of wastewater and sludge from different monitoring points (4 for wastewater and 3 for sludge) in Municipal Wastewater Treatment Plant, Stara Zagora, Bulgaria, for the period July 2013 – March 2014, by content of nutrient inputs (total N, total P and total K), absolutely dry matter, pH and electrical conductivity, in order to determine opportunities for their use in agriculture. For sampling and sample preparation of wastewater and sludge, international references of ISO and BSS were used. Sample analyses were made by equipment as follows: pH-meter Lab 850 (pH), Multi 340i/SET (electrical conductivity), method of Kjeldahl (total N), spectrophotometer UV/VIS 6705 JENWAY (total P) and AAC „AAAnalyst 800” – Perkin Elmer (total K). It was found that: 1) Treated wastewater has neutral pH, low electrical conductivity and low total K content, as well as lower content of total N and total P than the maximum allowed concentrations for their discharge into the receiving water body – Bedechka river, defined from

ecological point of view as a sensitive water body. 2) The effect of wastewater treatment in respect of total N was 87.4%, total P – 97.8% and total K – 23.0%, respectively. 3) Treated wastewater meets the requirements for irrigation of crops by indices: pH, electrical conductivity and content of total N, total P and total K. 4) The sludge has typical content of absolutely dry matter, neutral pH and high values of electrical conductivity, as well as lower content of total N (from 1.3 to 3.2 times), total P (from 3.2 to 7.8 times) and total K (from 4.4 to 12.2 times) in comparison with the sludge from 9 other WWTPs in the country, which is result of the modern technology of sludge treatment in WWTP-Stara Zagora. 5) Sludge contains more total N (from 2.71 to 7.5 times), comparable amount of total P and less quantity of total K compared with livestock manure.

**Key words:** Municipal Wastewater Treatment Plant, wastewater, sludge, nutrient inputs, assessment

### **30. Костадинова, Г., Д. Дерменджиева, Р. Стефанова (2015). Агроекологична оценка на тор и постеля от кокошки-носачки по съдържание на биогенни елементи и микроорганизми, *Животновъдни науки*, vol. LII, No 3, 42-53.**

**Abstract.** The aim of this paper was to study and assess fresh manure, litter and stored manure (mix of manure and litter) from layer hens, reared in a building (570 m<sup>2</sup>, 5 hens/m<sup>2</sup>), with capacity of 2000 layer hens on deep litter-loose housing (a mixture of sawdust and shavings with a thickness of 8-10 cm) for a period of 10 months. Samples of all substrates were analyzed monthly on the base of total N, total P and total K content, as well as total number of microorganisms (TNMs) and coli-titer. It was found that: **a)** the content of nutrients (N, P, K) and microorganisms in fresh manure, litter and stored manure varies as follow: total N: 1.05 - 2.11% (25.4 - 77.9 g/kg Dry Matter - DM), 1.65 - 3.36% (28.3 - 71.6 g/kg DM) and 0.92 - 1.50% (30.6 - 37.8 g/kg DM); total P: 0.26 - 0.67% (10.3 - 25.3 g/kg DM), 0.72 - 1.28% (12.9 - 24.1 g/kg DM) and 0.83% - 1.80% (27.7 - 48.4 g/kg DM); total K: 0.41% - 0.61% (11.1 - 26.9 g/kg DM), 0.56 - 1.00% (10.2 - 21.4 g/kg DM) and 0.18 - 0.67% (5.22 - 19.7 g/kg DM); TNMs: 4 000.103 - 150 000.103 CFU/g, 286.103 - 71 400.103 CFU/g and 625.103 - 81 100.103 CFU/g; Coli-titer: 0.0001 - 0.00001, 0.01 - 0.00001 и 0.001 - 0.00001; **b)** the content of total N, total K and TNMs decreased similarly in the chain “fresh manure - litter - stored manure” as follow: total N - an average with 7.6% in the litter and on average with 40.5% in stored manure compared that in fresh manure; total K - with 25.2% and with 33.5%, respectively; TNMs - with 46.3% and with 74.3%; Colititer was higher of litter (170.5 times) and of stored manure (8.5 times) compared to that of the fresh manure; **c)** the quantity of total P in fresh manure and litter retains similar levels, but increased by 47.0% in stored manure compared to fresh manure and with 46.4% in stored manure compared to the litter.

**Key words:** hens, manure, litter, N, P, K, microorganisms, coli-titer, assessment

### **31. Костадинова, Г. (2015). Сравнителна агроекологична оценка на тор от говеда и свине по съдържание на биогенни елементи, *Животновъдни науки*, vol. LII, No 4, 73-84.**

**Abstract.** The aim of this paper was to study and assess fresh and stored cattle and pig manure, for a period of 12 months by content of nutrients (N, P, K). Manure samples were collected monthly from the livestock buildings, manure storage and lagoons. They were analyzed for total N, total P and total K content by routine methods. It was found that: **a)** The content of N, P and K in the cattle and pigs' manure is in the range as follows: *cattle* - fresh and stored manure: Total N: 0.41 - 0.68% and 0.34 - 0.57%, Total P: 0.14- 0.19% and 0.12% - 0.17%; Total K: 0.20% - 0.51% and 0.12 to 0.32%; *pigs* - fresh and stored manure: Total N: 0.75 - 0.98% and 0.58 - 0.83%; Total P: 0.48 - 0.89% and 0.37% - 0.58%; Total K: 0.28 - 0.44%, and 0.12 to 0.22%; **b)** The loss of nutrients during the storage of manure of both animal species is not equal and is characterized by the following features: Total N: the losses are similar and vary in the following ranges, cattle manure - from 10.7% in spring to 20.2% in summer, on average 20.2%; pig manure - from 12.7% in winter to 22.1% in summer, on average 18.4%; Total P: losses in pig stored manure are larger than those of cattle manure, respectively, from 13.5% in winter to 37.2% in fall, on average 23.5% and from 10.2% in fall to 21.0% in summer, on average 14.0%; Total

K: losses are similar for both total P, and ranged from 46.4% in summer to 62.1% in winter, on average 54.8% for pig manure and from 30.6% in winter to 52.3% in spring, an average 42.5% for cattle manure; c) Pig manure contains a larger amount of nutrients (N, P, K) in comparison with cattle manure: total N, an average with 1.48 times for fresh and with 1.42 times for the stored manure (at  $P < 0.001$ ); total P, respectively with 3.39 times and 3.14 times (at  $P < 0.001$ ); total K, with 1.19 times for fresh manure, it was observed an inverse relationship for stored in manure, slightly higher are the levels of total K in cattle manure (with 1.07 times) as compared to pig manure.

**Key words:** cattle, pig, fresh and stored manure, nutrients (N, P, K), assessment

**32. Valkova, E., V. Atanasov, K. Velichkova, G. Kostadinova, M. Tzanova (2015). Chromium level in water, sediment, aquatic plants and meat of common carp (*Cyprinus carpio* L.) from different water bodies in Bulgaria, *Agricultural Science and Technology*, vol. VII, No 3, 334-338.**

**Abstract.** Chromium (Cr) is heavy metal often found in aquatic ecosystems due to its widespread use in households and industry. Reaching toxic levels in water, chromium may cause a violation of many metabolic processes in hydrobionts. The aim of the present study was to investigate and assess the Cr concentration levels in water, sediment, aquatic plants and meat of common carp from different surface water bodies in a region of Bulgaria with high anthropogenic impact. International standards of ISO and BSS for sample preparation of water, sediment, aquatic plants and meat of common carp analysis were used. Concentration of Cr in the analyzed samples was determined by atomic adsorption spectrometry. It was found that the Cr levels: a) in surface water varied from 0.012 mg/l in monitoring point (MP-5) to 0.043 mg/l in MP-6, all concentrations exceeded the maximum admissible concentration (MCA) – 8 µg/l (0.008 mg/l) for Cr (VI) according to Regulation No 4-H (2012) for characterization of surface water, from 1.5 times in MP 5 to 5.38 times in MP 6; b) in sediment ranged from 20.7 mg/kg in MP 1 to 199.9 mg/kg in MP 4, which are lower than the MCA for cultivated soil – 200 mg/kg dry soil according to Regulation No 3/01.08.2008 concerning norms for admissible content of harmful substances in the soil, from 1 time in MP 4 to 9.6 times in MP 1; c) in aquatic plants varied from 6.021 mg/kg in MP 3 to 23.2 mg/kg in MP 6; d) in common carp meat were between 0.11 mg/kg in MP 5 and 0.16 mg/kg in MP 3, which is lower than the MCA (0.3 mg/kg) for maximum permissible quantities for contaminants in food (Regulation No 31, 2004), from 0.37 times in MP 5 to 0.53 times in MP 3. Cr accumulation was not observed in the tested common carp meat samples, which most probably is due to its accumulation in organs with active metabolism (gills, liver); e) proportions of accumulation of Cr in the trophic chain are different for the different units – water/sediment (1040 – 12 129 times more), aquatic plants/water (207 – 1011 times more) and meat of common carp/water (9.1 – 12.1 times more).

**Key words:** aquatic plants, assessment, common carp, chromium, meat, sediment, water

**33. Костадинова, Г. (2015). Зависимости между нивата на замърсители на въздуха в свинеферма и абиотични фактори на средата, *Екология и Бъдеще*, vol. XIV, No 3, 27-37.**

**Abstract.** The purpose of this study was to examine and assess the levels of air pollution within and around buildings in a pig farm with capacity for 390 sows by  $\text{NH}_3$ ,  $\text{H}_2\text{S}$ , dust and total number of microorganisms (TNM) content and to seek statistical dependencies between these indicators of air quality and abiotic environmental factors (air temperature, humidity and velocity). The study was carried out for a one year period (January – December), through the first decade of XXI century, in a pig farm situated in Central South Bulgaria. Abiotic environmental factors were measured monthly during the sampling air collection for chemical and microbiological analysis in two monitoring points (MPs) - one in the production buildings for sows, growing pigs and fattening pigs, the other at 30 m away, outside of the buildings. Sampling air collection for chemical analysis and for determination of TNM were taken at 8 MPs as follows: MP-1 in the buildings for sows, growing pigs and fattening pigs, MP-2 at 2.0 m, MP-3 at 50 m, MP-4 at 100 m, MP-5 at 500 m and MP-6 at 1000 m distance of leeward side of

the farm; MP-7 at 10 m and MP-8 at 100 m from the windward side of the farm. It was found that: **a**) air quality in buildings for sows, growing pigs and fattening pigs do not meet the animal hygienic requirements on NH<sub>3</sub>, H<sub>2</sub>S and TNM count, as the average annual values exceed the permissible thresholds according to Regulation No 44/2006, respectively with 1.51, 5.11 and 1.10 times. Only the amount of dust is in the norm; **b**) emissions from the production buildings maintain in the air around them dust levels up to 50 m, NH<sub>3</sub> content up to 100 m, H<sub>2</sub>S and TNM content up to 1000 m of leeward side of the farm, and up to 100 m from the windward side of the farm, higher than the corresponding limit values according to Regulation No 14/1997; **c**) with increasing the distance from the production buildings NH<sub>3</sub>, H<sub>2</sub>S, dust and TNM content in ambient air decreased similarly as follow: at MPs of the leeward side of the farm, at 2 m - from 1.9 to 11.1 times, at 50 m - from 7.01 to 24.9 times, at 100 m - from 7.9 to 56.5 times, at 500 m - from 12.6 to 567.8 times and at 1000 m - from 23.0 to 2221.7 times; at the MPs of the windward side of the farm, at 10 m - from 2.1 to 12.3 times and at 100 m - from 10.8 to 1419.4 times; **d**) there are many correlations between air pollutants and abiotic factors of the environment by MPs as follows: between NH<sub>3</sub>, H<sub>2</sub>S and TNM content and air temperature (positive correlations); between NH<sub>3</sub>, H<sub>2</sub>S, dust and TNM content, and relative humidity (positive for NH<sub>3</sub>, H<sub>2</sub>S and TNM, negative for dust); between NH<sub>3</sub>, H<sub>2</sub>S, dust and TNM content, and air velocity (mostly positive for dust, positive or negative for NH<sub>3</sub>, H<sub>2</sub>S and TNM); **e**) created regression equations can be used for approximate determination in air of: NH<sub>3</sub> and TNM content, depending on distance (m) from the source of emissions (production buildings) and depending on the air temperature; H<sub>2</sub>S and TNM content, depending on relative humidity; H<sub>2</sub>S content, depending on level of NH<sub>3</sub>; the number of coliforms, depending on TNM.

**Key words:** pig farm, air temperature, humidity and velocity, NH<sub>3</sub>, H<sub>2</sub>S, dust, microorganisms, quality, correlations

**34. Костадинова, Г., Д. Дерменджиева, Г. Петков, Р. Стефанова (2015). Агроекологична оценка на тор и постеля от пуйки, Животновъдни науки, vol. ЛП, No 6 (под печат).**

**Abstract.** The aim of this paper was to study and assess fresh manure, litter and stored manure (mix of manure and litter) of from turkeys, reared in a building with capacity of 300 turkeys on deep litter-loose housing for a period of 10 months. Samples of all substrates were analyzed monthly on the base of total N, total P and total K content, as well as total number of microorganisms and coli-titer. It was found that: **a**) the content of nutrients (N, P, K) and microorganisms in fresh manure, litter and stored manure varies as follow: total N: 0.70% - 1.94% (29.9-91.3 g/kg Dry Matter - DM), 1.29 - 2.81% (19.0 - 66.9 g/kg DM) and 0.88 - 1.40% (24.2 - 39.3 g/kg DM); total P: 0.26 - 0.68% (11.0 - 28.7 g/kg DM), 0.68 - 1.19% (10.1 - 23.6 g/kg DM) and 0.87 - 1.86% (27.4 - 48.8 g/kg DM); total K: 0.27 - 0.79% (11.4 - 43.1 g/kg DM), 0.53 - 1.02% (7.89 - 21.8 g/kg DM) and 0.10 - 0.52% (3.38 - 14.1 g/kg DM); total number of microorganisms (TNMs): 2000.10<sup>3</sup> - 115 000 10<sup>3</sup> CFU/g, 818.10<sup>3</sup> - 900.10<sup>3</sup> 40 CFU/g and 500.10<sup>3</sup> - 7 142.10<sup>3</sup> CFU/g; Coli-titer: 0:01 - 0.0000001, 0.01 - 0.00003 and 0.01 - 0.00001; **b**) the content of total N, total K and TNMs decreased similarly in the chain “fresh manure - litter - stored manure” as follow: total N - an average of 25.5% in the litter and on average 51.0% in stored manure compared that in fresh manure; total K - with 31.7% and with 54.1%, respectively; TNMs - with 64.0% and with 93.3%; Coli-titer was higher of litter (5 times) and of stored manure (3 times) compared to that of the fresh manure; **c**) the quantity of total P decreased with 19.4% in litter compared to that in fresh manure, but increased with 38.8% in stored manure compared to that in fresh manure, and with 50% compared it to the litter.

**Key words:** turkeys, manure, litter, N, P, K, microorganisms, coli-titer, assessment

25.11.2015 г.

Изготвил справката:.....

(Доц. дн Г. Костадинова)