СЕЛЬСКОХОЗЯЙСТВЕННЫЕ И БИОЛОГИЧЕСКИЕ НАУКИ

ENVIRONMENTAL ASSESSMENT OF SOIL CONDITION INFLUENCED BY ANIMAL COMPLEXES OF VARIOUS CAPACITIES

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Abstract. In recent years, livestock farms have been the most widespread source of environmental pollution. The emissions of most of them far exceed the established norms. In addition, the size of the sanitary protection zones, determined several tens of times, does not sufficiently improve the condition of the soil beyond. It is now necessary to revise these standards and create new ones that will fit the transition zone from the source of pollution to clean areas.

Keywords: sows, pollution, microbiological parameters, sanitary protection zones.

Pig-breeding – one of the main branches of Ukraine livestock of which production is 1/3 of the gross meat production in the country. According to analytical department data from the Association of "Pig Farmers in Ukraine" in 2018, there were 217 thousand tons of pork produced in Ukraine, which is 4.1% more than for the same period in 2017 year.

In the scientific literature, a considerable amount of information describes the processes of breeding, keeping and feeding pigs. However, the assessment in the ecological position of the environment due to the impact of pork production compares the conditions of intensive farming technology, with various capacity, in the regions where enterprises is located with a complex of criteria, is not described enough.

Microbial numbers. It should be noted that there was a significant (by twice-thrice) growing of microbial organism numbers in the stuied soils near the livestock farms, comparing the values of the microbial soil number in Sanitary Protection Zone (SPZ) farms with the control variant value. It has been established that there is a positive correlation between the capacity of livestock farms and soil pollution in controlled areas. In the investigation of inexes above, specific sanitary soil condition outside the SPZ entreprises, is satisfactory.

Seasonal dynamics is also observed in soil microbiological pollution. There is a considerable increase of microbial organism amounts in the SPZ soils of studied livestock farms and control index is increased by 2.4- 3 times, in summer.

Microbial numbers are significantly lower in spring and autumn compared to summer, although they still exceed the control indicators by 1.3-2.3 times, in addition, the autumn indicators are much lower than the spring are.

The lowest indexes are typical for the winter period, but even in this time they are exceed the control by 1.6-2.1 times.

In the soils outside of SPZ livestock farms and the control section, microbial number are typified by slight fluctuations during the year: this indicates microbial organism amounts in the summer period exceed winters by 1.6-2.1 times.

The total quantity of soil microflora. According to the results of conducted researshes, it may be concluded that there is a sharp increase in the soils near the studied farms (by 7-15 times in comparison to data obtained from outside the SPZ and controlled areas) of the total number of microflora in the soil within the SPZ, is evident by the presence of a significant amount of animal waste.

Pollution of surrounding areas increased with growing numbers of livestock populations on the farms. It should be noted that the livestock farms SPZ's sizes are provided by the self-cleaning of studied soils sufficiently.

Growth rate in summer is increased (by 8–13 times compared to data showing growth rates in winter) for the livestock farms SPZ soils in seasonal dynamics of the soil microflora total amount, by means of conducted researches. Off-season values of soil microflora amount in studied SPZ farms soils, except low power enterprises, exceeds the winter values by 4.1 – 4.5 times in spring and 8 times greater in autumn.

A characteristic decrease of microflora amount only in winter for low-capacity SPZ livestock enterprises. Spring and autumn indeces are lower than summer only by 1.3 and 1.6 times accordingly. In this case, the control values of soil microflora is comparable with the corresponding indeces of SPZ livestock farms, exceeds in 4-15 times in summer, in 12-16 times in the off-season and 6-11 times -in winter.

Significantly lower fluctuations are observed over the year in soil microflora values outside SPZ and control soil: summer indeces exceeds that of winter by 6-9 times, spring and autumn exceeds winter by 2-3 times.

Micromycetes. The activity of livestock farms significantly degrades the conditions of micromycetes activity: within the SPZ of the studied enterprises the amount of micromycetes are 2.1-4.5 times lower than outside them and are 6-12 times lower than the control values.

It is established that the size of SPZ does not sufficiently provide the purification of soil, which is confirmed with the decrease of CFU micromycetes amounts in the studied soils outside of livestock farms SPZ, than in control soil version (by 1.2 – 3.2 times)

Around the farms, the level of soil pollution increases according to livestock farms capacity increasing , as evidenced by the decrease of

micromycetes amount in surrounded territories soils.

The seasons are very important for the level of soil pollution; in the summer period micromycetes amount in the soil decrease sharply in comparison to winter by 10-25 times, within livestock farms SPZ and by 20-50 times outside them.

Values of micromycetes amounts are closely related to each other in the off-season (though spring values are slightly lower than the autumn one) but increases the winter values by 1.6-2.5 times.

However, as for studied soils, the control soil is characterized by the same seasonal dynamics. Micromycetes CFU value amounts increase by 5 times in summer, by 5-12 times in off-season and by 5-11 times in winter for SPZ soil farms, and also by 2-6, 2-4 and 1.5-2.8 times accordingly for the outside SPZ soils.

Streptomycetes. It has been established by experimental investigations, that the amount of streptomycetes increases by 2.7-5 times within livestock SPZ farms in comparison to outside SPZ values and the control. The level of soil pollution with streptomycetes increases in direct proportion to the growth in livestock farms capacity.

It should be noted, that sufficient soil purification is provided by the size of SPZ farms.

Seasonal dynamics is also inherent for the streptomycetes amount in the soils around livestock farms. In particular, in studied soils outside livestock SPZ farms, the fluctuations of these microorganisms amounts during the year is a lot more than in SPZ soils; In the first case, the values in summer period of this index exceeds the winter by 18-22 times, in others - 3.6 times. Such differences may be explained by the fact that the size of SPZ livestock farms outside them provides good soil purification in the winter period, while the soils within SPZ are polluted even in winter, although much less than during other seasons.

Streptomycetes values in the studied soils of spring and autumn seasons are bigger than winter's by 1.6-3.8 times within SPZ livestock farms and by 5-8 times outside them.

It is established, that the control area indexes are close to received values outside the SPZ over the year, but relative to the values of streptomycetes amount in the soil of livestock farms SPZ they are lower by 2.2-5.3 times in summer, by 2.8-5.2 times in spring and autumn and by 9-22 times in winter seasons.

Ammonifying microorganisms. On the basis of some conducted research, it may be established, that is still overweight their negative impact. The ammonifying soil ability within the SPZ livestock farms in comparison the control is reduce by 2.1-3.5 times and by 1.4-1.8 times compared to soils outside the SPZ.

The ammonifying area soil's ability is increase in inverse proportion to the growth of livestock farms capacity of the surrounded to the farms areas. That is, soil pollution by the studied farms exceeds according to growth of that farms capacity.

It should be noted, that established sizes of the studied SPZ livestock farms do not provide index' increase, and outside the SPZ enterprises ammonifying soil ability is lower by 2.5-3.4 times than the control value.

Ammonifying soil ability has a clear seasonal dynamic. In winter, the titer of ammonifier is close to zero almost in every studied area, but within the SPZ of livestock enterprises it exceeds the corresponding control value by 5-13.5 times. The titer of ammonifier is significantly increase in warmer seasons: in summer-80-176 times depending on capacity of the livestock enterprise relative to winter and by 1.1-1.8 times in comparison to the control; in spring and autumn – by 45-150 times and 2.2-5.3 times accordingly.

CONCLUSIONS

Therefore, the ecological soil condition around the livestock farms of various capacity is deteriorating, and within the SPZ, soils belong to the category of "little polluted". Outside the SPZ farms, incomplete soil purification was observed, according to physiochemical and sanitary-microbiological indexes.

LITERATURE

1. Agriculture, Trade and the Environment: The Pig Sector [Electronic resource]. – Available online: https://www.oecd.org/tad/sustainable-agriculture/19430433.pdf.

2. An HSI Factsheet The Environmental, Public Health, and Social Impacts of Pig Factory Farming Sector [Electronic resource]. – Available online: http://www.hsi.org/assets/pdfs/hsi-fa-white-papers/an_hsi_factsheet_the.pdf.

3. Bhat, P.N. Pig Production / P.N. Bhat, N.H. Mohan and Sukh Deo. –Delhi: Global Media, 2010. – 256 p.

3. Chemical Oxygen Demand of Polluted and Waste Waters. – London: Her Majecty's Stationery Office, 1978. – 234 p.

4. Donham K. The impact of industrial swine production on human health // In Thu K. Pigs, Profits, and Rural Communities / K. Thu, E. Durrenberger. – Albany, NY: State University of New York Press, 1998. – PP. 73–83.

5. Dunn, N. The impact of animal nutrition on the envinment / N. Dunn. – Feed Mix, 1999. – Vol. 7(3). – #8. – P. 10–11.

6. Evans M. The environmental impact of the disposal of waste in large scale pig production [Electronic resource]. – Available online at: http://www.earthtimes.org/business/environmental-impact-disposal-waste-large-scale-pig-production/433.

7. McAllister, T.A. Role of livestock in microbiological contamination of water: Commonly the blame, but not always the source / T.A. McAllister and E. Topp // Animal Frontiers, 2012. – # 2(2). – P. 17–27.

8. Page, A. L. et al. Methods of soil analyses. Part 2. American Society of Agronomy and Soil Science of America. – Madison, 1982. – 551 p.

9. Pigs and Environment [Electronic resource]. – Available online at: http://www.fao.org/ag/againfo/themes/en/pigs/Environment.html.