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SOME QUESTIONS ABOUT THE ECOLOGICAL CONDITIONS OF GROWING AGRICULTURAL PLANTS IN THE SOUTHERN ARAL SEA REGION

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Abstract

This review article analyzes and discusses potential links between environmental conditions in the Southern Aral Sea region and the food safety of plant products. A significant place in the article is devoted to the dynamics of diseases associated with the deterioration of environmental conditions (climatic changes, pollution of soils, water and atmosphere, soil salinization). A literary review of foreign publications has shown that chemical pollution of the environment is considered to be the dominant risk factor for food safety. For the UP region, an additional environmental factor is the drying up of the Aral Sea, which is inextricably linked to the removal of salts from the drained bottom, which contain toxic sulfates. An important factor in food safety risks is climate warming, which provokes an increase in plant pathogens and parasites, as well as shortening the transportation and storage time of agricultural products.

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Introduction

It is known that the third most important (after water and air) condition for human life and health is proper nutrition, including food safety in this concept. According to the generally accepted definition [27], food safety is a state of reasonable confidence that food products under normal conditions of their use are not harmful and do not pose a danger to the health of present and future generations. Food security issues are inextricably linked with the problem of food security, the solution of which is an integral part of the political and economic strategy of all states. Food security is based on four principles: the availability of sufficient food products; the economic availability of food; the consumption of the necessary amount of food products in accordance with the norms of the diet; stable access to quality and safe food [21].

Here are quantitative estimates of social losses as a result of food safety violations: 600 million people fall ill annually from the consequences of eating low-quality food contaminated with microorganisms or chemicals, that is, almost every 10th inhabitant of the planet, and 420,000 people die, which leads to the loss of 33 million years of healthy life; Each year, in low- and middle-income countries, the economic cost of lost productivity and medical costs associated with the consumption of unsafe food is $110 billion. United States; Forty per cent of the burden of foodborne diseases affects children under 5 years of age, and 125,000 children are killed each year; Every year, 220 million children are infected with diarrhoeal diseases, of whom 96 000 die [27].

According to a 2018 World Bank report [28], the cumulative economic cost of foodborne disease-related productivity losses in low- and middle-income countries is nearly $100 billion. The annual cost of treating foodborne diseases is estimated to reach $15 billion. [29].

In this regard, the problem of food safety is receiving more and more attention at the state level. Uzbekistan has adopted the Law "On the Quality and Safety of Food Products" dated 30.08.1997 No483-1, which regulates relations in the field of "catering, ensuring the quality of food products and their safety for human health and future generations" [1].

The issues of ensuring the safety and quality of products at the national level that are subject to priority scientific decision in environmental research include:

Science-based food safety management and decision-making by providing constructive scientific advice in support of food safety standards;

Risk analysis of food chains, taking into account the specificities of national and regional food systems;

data collection and forecasting in the field of food safety;

Body. Since plants are the basis of the food chain for living organisms, special attention should be paid to the ecological conditions of the growth of agricultural plants.

The use of genetic modification of plants (GMO), fertilizers, disinsection treatment of agricultural fields, on the one hand, improve the quality of products, on the other hand, have consequences that can manifest themselves in many years on subsequent generations. Of particular concern are modern technologies for the production of finished products, which are replete with preservatives, dyes and other additives to improve the taste and appearance of products.

The global problem of food safety arises not only in connection with the increasing chemicalization of food production, but also in connection with the deterioration of environmental conditions for the growth of agricultural plants. This is especially true for the South Poland region, which is the epicenter of the Aral Sea crisis. Ecological stressors of agricultural plants in the South Pole are deterioration of the water regime, climate warming, soil salinization, aerosol, chemical and biogenic pollution of the environment. Let's consider the main reasons leading to risks to food safety and public health in this region.

Drying up of the Aral Sea. The drying up of the Aral Sea has led to salinization of soils in irrigated areas and an increase in the salinity level of groundwater in combination with salinization of rivers and canals [23, 9, **10**, **11**]. Salts from Aralkum not only reduce the productivity of agricultural plants by saline the soil, but also accumulate in the root system and fruits, and can pose a health hazard. which helps the nervous system to work properly [5]. The kidneys help regulate the concentration of electrolytes in the body [6]. However, an increase in salt concentration can disrupt standard biological mechanisms and lead to a number of diseases [7]. Since salt levels in the region are very high, the local population, receiving excess salts from atmospheric dust, water, and food, suffers from diseases such as hypertension, hypercalciuria, cardiovascular diseases, high blood pressure, kidney stones, and impaired bone metabolism [8]. Because of this, the local population of the Aral Sea region (Kazakhstan and Uzbekistan) faces various respiratory problems and the accumulation of kidney stones [12]. Metals such as lead, mercury, and cadmium persist in the salt crust, occurring in higher concentrations among this population, leading to anemia.
Sulphates are a particularly toxic fraction of salts from Aralcum. According to studies by foreign scientists, "In general, epidemiological and toxicological data have little or no support for a causal relationship between PM sulfate and the health risk at environmental concentrations" [25].
However, such a conclusion is not justified for the conditions of the South Pole, where the concentration of sulfates from Aralkum is much higher. Due to the uniqueness of the large-scale wind removal of salts from the dried bottom, there are no quantitative estimates of the relationship between the increased concentration of sulfates and chlorides in the atmosphere and the increase in the number of respiratory tract diseases in the world literature diseases of the respiratory tract with the dynamics of the concentration of sulphates in the air. Model calculations showed the spatial and temporal coincidence of the salt concentration field with the zoning and dynamics of respiratory diseases. The high correlation coefficient (0.7 on average in the region) substantiates the relevance of continuing this study relative to the dynamics of other pathologies in the Southern Aral Sea region, as well as in order to obtain an analytical expression of the relationship between salt removal → disease dynamics" [26].
Since it is difficult to isolate the contribution of a specific pollutant from the many factors influencing a particular disease in routine medical examinations, the use of quantitative methods for this purpose is more effective.
The LDPE of morbidity was studied in detail in the work [22] The Ministry of Health and Social Development of Kazakhstan conducted a comprehensive study in order to study the

health of the population of the Aral Sea region. The study area is divided into three zones: catastrophe, crisis and pre-crisis. The criteria for determining the boundaries were: (1) for the disaster zone: a steady increase in mortality, forced migration for environmental reasons, colossally exceeded concentrations of pollutants in the the destruction of ecosystems and their loss of the ability to self-restore, catastrophic shallowing of water bodies; (2) for the crisis zone: a steady increase in the specific morbidity of the population, a significant excess of the standards for maximum permissible discharges of pollutants into the environment, a decrease in the species composition and a decrease in the biological productivity of ecosystems by 75 percent, drying up of water bodies; and (3) for the pre-crisis zone: a steady increase in environmentally caused diseases, a stable excess of concentrations of pollutants in the environment, a decrease in the species composition and a decrease in the biological productivity of ecosystems by 50 percent, drying up of water bodies. The following settlements were studied: in the disaster zone - Aralsk, Kazalinsk, Shalkar, which is located within 0-250 km; in the crisis zone - Karmakshi, Zhalagash, which is located within 250-370 km; and in the pre-crisis zone - Arys, Irgiz, Ulytau, which is located within 370-810 km from the Aral Sea. These zones were compared with the control region (Zhanaarka), which was located at a distance of 811 km from the Aral Sea (Fig.-1).

Fig.1. Study area of the Aral Sea region in Kazakhstan,

Kyzylorda region

An increase in respiratory diseases in the disaster zone was revealed from 9467 diagnosed people (per 100 thousand population) in 1991 to 10744 (per 100 thousand) in 2016. The number of people with respiratory diseases in the disaster zone in 2016 slightly differed depending on the number of cases in the crisis (9247) and pre-crisis (9079) zones. The number of people in the control zone differed significantly - 5879 people per 100 000 population. Researchers [1, 7] studied the respiratory and pulmonary functions of children in the disaster zone. 8.1% of the examined children in the study area were found to have a chronic cough in the study area, compared to 4.6% in the control area. The study looked at subjects living 200 km and 500 km from the Aral Sea. Some studies have been conducted in neighbouring countries. An annual analysis of asthmatic status in Central Asia showed that about 113 per 100,000 people had asthma in the Khorezm region (Uzbekistan), more than three times the average for Uzbekistan (38 cases per year per 100,000 population). In Karakalpakstan, the rate was 67 per 100,000 people, double the national average [18].

In the zones of catastrophe and crisis, the incidence of malignant neoplasms increased by 61.9% (211.6) and 57.2% (205.4) per 100,000 population, respectively, compared to the control region (130.7). The incidence rate in the pre-crisis region is 152.7 per 100 thousand population, which is 16.8% higher compared to the control region, but 18.8% lower than the average in the Republic of Kazakhstan.

The clear zonality of the growth of diseases indicates the unconditional impact of the drying up of the Aral Sea. But it should be noted that only part of these diseases occurs through the direct consumption of contaminated agricultural plants. Another part of the diseases occurs along the food chain when eating livestock products.

Environmental pollution. Decades of chemical agricultural practices in the South Sea region have led to high levels of toxic pesticides in the local environment, their accumulation and spread throughout the Aral Sea region [18]. Since the 1960s, organochlorine compounds (OCs): dichlorodiphenyldichloroethylene (DE) and dichlorodiphenyl trichloroethane (DDT), propaneide, hexachlorohexane (HCH), hexachloran, and butyphos have been used in large quantities as pesticides [2]. Butt pesticides are given mainly with food [15] when consuming dairy products and fish [4]. Samples of oil, cottonseed oil, and cooking oil were collected to test whether contaminants were affecting food safety. 2,3,7,8-tetrachlorodibenz-paradioxin (TCDD) has been detected in cottonseed and HCH in oil, lamb, eggs, carrots, and onions affected by these toxic chemicals [3,4]. The study [20] revealed the effect of pollutants on the hormonal profile in children living in the region.

The Aral test site, which was built on Vozrozhdeniya Island, was once known for its biological weapons test center. The northern part of the island ("Mergensay") now belongs to Kazakhstan [13], and the southern part of the island belongs to Karakalpakstan. The test site was created due to the biological warfare race between the United States, the USSR and the United Kingdom in 1952, when the Ministry of Defense of the Soviet Union began the work of the PNIL Field Research Laboratory for biological weapons testing. The island was infected with infectious diseases such as anthrax, smallpox, plague, tularemia, brucellosis, and typhus, which were tested on local animals [14]. The survivability of microorganisms is known, therefore, they can persist in the soil for a long time and be transported over long distances during PB. In addition, rodents can become carriers of the above diseases due to improper disposal of the laboratory [15].

The development of gas fields in the south-west of the ODA causes man-made pollution of the environment with heavy metals [2]., which does not contribute to the food safety of the products of household plots of nearby villages.

Thus, unsafe plant products due to air, water and soil pollution with sulfates, pesticides, nutrients, arsenic, cadmium, mercury and lead exacerbate the problem of increasing disease.

These toxic substances accumulate in plants and, following the food chain, get to local animals, accumulating in the kidneys and liver, and then into the human body.

Climate change. [22] The emergence of foodborne pathogens is also a growing concern for health authorities, as the number of pathogens known to be foodborne is increasing (Mor-Mur and Yuste, 2009), making it difficult to calculate the extent of foodborne diseases. Studies confirm that climate-induced environmental changes will increase the burden of foodborne and waterborne diseases. The level of exposure is likely to vary considerably depending on the pathogen and geographical location. Temperature fluctuations and changes in precipitation patterns caused by climate change affect the persistence of pathogens in the environment by altering their transmission rate, range, and viability. Altered and prolonged summer seasons affect the frequency and severity of seasonal foodborne diseases. The link between rising monthly temperatures and episodes of food-induced diarrhea is well documented and has been documented in Australia, Israel and the Pacific Islands. Climate change can also change the seasonal patterns of outbreaks. For example, it is hypothesized that a bimodal pattern of incidence may occur, peaking at the beginning and end of the summer season, with a decrease in mid-summer when temperatures are well above the pathogen's thermal optimum. It is hypothesized that high temperatures associated with climate change may lead to thermal stress in livestock, leading to increased shedding of enteric pathogens that can exceed control food systems and enter the food chain. The release of shigellose toxin produced by Escherichia coli due to stress caused by high temperature has been reported in cattle herds in Michigan, United States of America.
Pathogens with low contagious doses (intestinal viruses, parasitic protozoa, Shigella species, enterohaemorrhagic bacillus of Escherichia coli, E. coli O157:H7) and those with high environmental persistence (Salmonella species) are more likely to cause large outbreaks due to environmental changes caused by climate change; for example, an increase in temperature contributes to a higher rate of replication in Salmonella. An analysis of trends in foodborne illness outbreaks in the Republic of Korea suggests that there is a strong positive association between infections caused by foodborne pathogens Escherichia coli, Vibrio parahaemolyticus, Campylobacter jejuni, Salmonella aureus and Bacillus cereus and changes in air temperature and precipitation (relative humidity).
A 2007 IPCC report states that an increase in daily temperatures is likely to lead to an increase in cases of food poisoning, especially in temperate regions (IPCC, 2007). Studies in Germany (data collected from 2001 to 2004) and in the United States of America (data from 1992 to 2001) showed that increases in ambient temperature correlated with increases in cases of salmonellosis and campylobacteriosis (Naumova et al., 2007; Yun et al., 2016). Temperature also affects the contact between food and insects, vectors of pathogens such as flies and cockroaches, where higher insect activity is associated with higher temperatures (IPCC, 2007). Changes in precipitation patterns are also likely to affect the incidence of foodborne illnesses. The entry of various foodborne pathogens—Salmonella spp., Escherichia coli, and norovirus—through the roots of various plants has been documented (Bernstein et al., 2007; López-Velasco et al., 2012; Zheng et al., 2013). This intralition process poses a threat to human health if food

is consumed raw, as these pathogens cannot be eliminated through washing or disinfection methods. A study that looked at the effects of simulated water stress and excess water on the intraility of Salmonella in fresh green vegetable leaves found that the rate of intake increased in both conditions.

Conclusion

Following the aphorism "Look at the root", the emphasis is placed on agricultural plants, which are the basis of the food chain. In general, food safety is based on the quality of ecological conditions of plant growth, therefore, such negative factors as drying up of the Aral Sea, environmental pollution, global warming are analyzed in detail according to literary sources.
The observed increase in diseases in the Aral Sea region has many factors, among which an important place is occupied by the unsatisfactory quality of water, air and soil, which affects, in particular, the quality of agricultural products. It should be noted that these factors also cause prolonged mutation of plants, which, as a rule, do not improve their productivity.
In general, the review of the literature showed the existence of many uncertainties in the relationship between environmental conditions and the role of plants in food security. Basically, there is a small number of studies of these relationships at the physiological and cellular levels.

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