
Analysis of Ecological and Toxicological Safety of Agricultural Raw Materials of Uzbekistan

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Abstract: *The article is devoted to the current problem of food safety. Particular attention is paid to tubers (potatoes), root crops (carrots), nightshade (tomatoes) and melon (cucumbers) crops grown in the Bukhara region of Uzbekistan and capable of producing high yields in agrometeorological zones with high salinity and drought-prone land. The analysis of the ecological and toxicological properties of soil, water and vegetables has been carried out, microbiological and pathogenic indicators of the quality of the investigated raw materials have been determined. It was established that vegetables grown in the Bukhara region comply with the sanitary and epidemiological requirements of Uzbekistan, which determines the possibility of exporting them abroad.*

Keywords: Agricultural products, vegetables, soil, water, safety, environmental and toxicological indicators.

INTRODUCTION

The problem of ensuring food safety is the most important state and scientific priority aimed at maintaining and improving the health of the population, the production of high-quality and safe products. The deterioration of the environmental situation in the world, associated primarily with anthropogenic human activity, has affected the quality of the food consumed. It is with food products that up to 70.0% of pollutants of various nature enter the human body from the environment. These substances enter and accumulate in food products along the biological chain, which provides the exchange between living organisms and air, water and soil, and the food chain, which includes all stages of the production of food raw materials and food products, as well as their storage, packaging and labeling. In this regard, ensuring the safety and quality of commercial raw materials and food products is one of the main tasks that determine the health of human society and the preservation of its gene pool [1, p.4-5].

The Development Strategy of the Republic of Uzbekistan for 2020-2030 [2] in the field of healthy nutrition of the population as the main priorities provides for a significant expansion of the production of high-quality and safe products. The strategy for the further development of the country outlines the tasks of "... introducing continuous monitoring of the implementation of the food safety assessment system based on internationally recognized methodologies and best practices ...".

MATERIALS AND METHODS

Uzbekistan is one of the largest producers of fruits, vegetables and their juices. Over the past 20 years, vegetable growing, melon growing, gardening and viticulture have developed especially intensively in the republic. Today, 1 million 700 thousand tons of horticulture and viticulture products, 5 million tons of vegetable and melon crops and potatoes are produced annually in the republic. In the coming years, it is planned to bring the production of fruits and vegetables and grapes up to 7.1 million tons, of which 500 ... 550 thousand tons are planned to be delivered fresh for export annually, so the quality and food safety of these products is of paramount importance [3].

The purpose of the study was to determine indicators characterizing the environmental and toxicological properties of agricultural products grown in Uzbekistan.

The object of the study was individual representatives of tubers (potatoes - lat. *Solanum tuberosum*), root crops (carrots - lat. *Daucus*), solanaceae (tomato - lat. *Solanum lycopersicum*) and melons (cucumber - lat. *Cucumis sativus*) grown in the Bukhara region of Uzbekistan.

Yields and environmental and toxicological parameters that determine the safety of agricultural food products are mainly determined by the chemical composition of the soil and water, as well as the fertilizers used to grow them, therefore, first of all, we analyzed the composition of soil and water, and then we determined the safety indicators of vegetables.

RESULTS

The studies were carried out in the Accredited complex of the testing laboratory of the Bukhara Center for Sanitary and Epidemiological Well-Being. The quality indicators of soil, water and raw materials were determined according to standard methods described in MU 0211-06 [4] and manuals [5,6]. Microbiological and parasitological evaluation of water and raw materials was carried out in accordance with the requirements of SanPiN No. 0366-19 [7],

The results of the study are given in table 1-3.

Ecological and toxicological properties of soil and water for individual inorganic components are presented in Table 1.

Table 1. Ecological and toxicological indicators of soil and water quality

Name of parameters (requirements)	Value basic indicators of SanPiN No. 0366-19		Value actual indicators	
	The soil, in mg / kg air-dry mass	Water, in mg / l	Soil in mg / kg air dry weight	Water, in mg / l
Nitrate (NO ₃)	130,0	45,0	124,8	46,7
Copper (Cu)	3,0	1,0	1,25	0,01
Zinc (Zn)	23,0	5,0	22,0	0,00
Arsenic (As),	2,0	0,05	0,08	0,00
Lead (Pb)	20,0	0,03	9,42	0,00
Cadmium (Cd)	5,0	0,01	3,16	0,00
Mercury (Hg)	2,1	0,005	0,05	0,00
Fluorine (F)	130,0	0,7	112,3	0,22
Total hardness, mEq / L	-	7,0-10,0	-	18,00
The dry residue, mg / l	-	1000-1500	-	893,0

* not normal. - not standardized

As follows from the experimental data (Table 1), the analyzed soil and natural water samples practically correspond to the normative (basic) environmental and toxicological indicators of SanPiN No. 0366-19 [7, p. 111]. However, the rigidity of water samples was almost 8 times higher than the upper value of the base standard indicator. The dynamics of the presence of solids in the studied water samples was similar to hardness, but did not exceed the baseline.

Next, we studied the indicators of environmental safety of vegetables (Table 2).

Table 2. Indicators of the level of environmental - toxicological safety of vegetables

Index	The value of indicators SanPiN No. 0366-19				
	According to ND, no more	potatoes	carrot	tomatoes	cucumbers
Heavy metals, mg / kg:					
- mercury	0,02	0,006	0,005	0,00	0,00
- cadmium	0,03	0,008	0,011	0,009	0,010
- lead	0,50	Следы	Следы	0,00	0,00
- zinc	10,0	4,016	4,012	1,234	1,345
- chromium	0,20	0,038	0,031	0,019	0,016
- copper	5,00	2,620	2,534	2,016	2,046
Non-metals, mg / kg:					
- iodine	1,00	0,00	0,00	0,00	0,00
- arsenic	0,20	0,007	0,005	0,00	0,002
- selenium	0,50	H/o	H/o	H/o	H/o
- antimony	0,30	H/o	H/o	H/o	H/o
- fluorine	2,50	1,244	1,187	0,745	0,968

Ion - nitrates, mg / kg:					
- potatoes	250,0	239,2	-	-	-
- carrot	400,0	-	176,8	-	-
- tomatoes	300,0	-	-	137,3	-
- cucumbers	400,0	-	-	-	125,5
Pesticides, mg / kg:					
- hexachlorocyclohexane (α -, β - and γ -isomers)	0,500	Следы	Следы	H/o	H/o
- DDT and its metabolites	0,100	0,00	H/o	H/o	H/o
Radionucleides, Bq / kg:					
- cesium - 137	120	H/o*	H/o	H/o	H/o
- cesium - 90	40	H/o	H/o	H/o	H/o
Aflatoxin B, mg / kg	0,05	0,00	0,00	0,00	0,00

* N / a - not found

It was found that the mass fraction of heavy toxic metals, non-metals and nitrates did not exceed the MPC, pesticides and radionucleides were not found in the studied vegetable samples. The data obtained indicate the conformity of the quality of the studied products to the regulatory requirements of environmental and toxicological safety SanPiN No. 0366-19 [7, p.90-91].

DISCUSSION

The determination of microbiological and parasitological contamination of the studied products was carried out using nutrient agarized media. The substrates were incubated under optimal conditions for the growth of colonies of microorganisms, and then, by phase contrast microscopy, the species and quantitative composition of the microflora of the studied semi-finished products were determined (Table 3).

Table 3. Microbiological and pathogenic indicators of the quality of vegetables

Index	The value of indicators SanPiN No. 0366-19				
	According to ND, no more	potatoes	carrot	tomatoes	cucumbers
microbiological indicators:					
KMAFANM, CFU / g, no more	1×10^4	$2,4 \times 10^3$	$2,1 \times 10^3$	$6,4 \times 10^2$	$0,8 \times 10^3$
BGKP (coliforms), 1 g	N / A	Not detected			
Pathogenic indicators:					
- salmonella in 25 g	N / A	Not detected			
- yeast, CFU / g, not more than	1×10^2	$0,6 \times 10^2$	$0,6 \times 10^2$	$0,3 \times 10^2$	$0,2 \times 10^2$
- mold, cfu / g, not more than	1×10^2	$0,03 \times 10^2$	$0,05 \times 10^2$	0,00	$0,01 \times 10^2$

- Listeria monocytogenes in 25 g	N / A.	Not detected
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According to microbiological indicators, the studied vegetable samples met the requirements of SanPiN No. 0366-19 [7, pp. 91-92].

The microflora of vegetables is represented mainly by soil microorganisms, microscopic fungi, various types of acid-forming bacteria and yeast. Found mainly rod- (3-5 in the field of view) and coccoid (7-9 in the field of view) bacteria.

CONCLUSIONS

Thus, it has been established that vegetables grown in the Bukhara region of Uzbekistan, according to their ecological and toxicological properties, comply with standard indicators and are environmentally “clean” products. Therefore, these products can be successfully used in the nutrition of the local population, as well as exported abroad. Basic research on the properties of agricultural products that determine their food safety is an essential condition for organizing a healthy and safe diet.

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