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RESEARCH ARTICLE

Ecological Status of Soils and Vegetable Products in Cherkasy Region

O.I. Ulianych, S.V. Schetyna, G.Ya. Slobodianyk, A.G. Ternavskyi, O.V.Kuhniuk, I.A. Didenko

Uman National University of Horticulture, Uman, Ukraine
E-mail: olena.ivanivna@gmail.com
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The condition of radionuclide soil contamination of Cherkasy region and vegetable products grown on them were investigated. It was established that the level of radionuclide contamination of soil and vegetable crops does not exceed pollution control standard and is actually 20-100 times lower compared to 1990-ies of 20th century. The fact that indicators of radionuclide content over the past decades are stable in most parts of the region is positive. Taking into account the cumulative properties of certain radionuclides, this problem should be the focus of scientists of different areas of expertise. It was investigated that the radionuclide contamination of soils and vegetable products grown on them in Cherkasy region depends on the structure and physical indicators of soil and its acidity, the depth of the samples taken, etc. It was suggested to continue systematic observation and monitoring of the level of radioactive contamination of the soil, vegetables and potatoes with the aim of reducing the content of radionuclides.

The climate change has become more arid in Ukraine over the past decades. The moisture deficit becomes more and more tangible from year to year for the cultivation of agricultural plants and vegetables in particular, which requires additional irrigation. Due to the weak root system vegetable plants require much water, and in case of shortage, they tend to accumulate harmful elements, including heavy metals in the parts that are consumed by humans afterwards. Also, due to the lack of moisture during the period of plant growth, the quality of primary produce for the processing industry will be substantially lower. In addition, the constant rise in the cost of energy and water requires new ways to save water and energy. The solution to this problem might be the introduction of polymeric substances (hydrogel) into the soil, which can accumulate a significant amount of moisture due to its porosity and provide plants with it during the required period. In this regard, in terms of Cherkasy region, we conducted a three-year study on the use of various forms of hydrogel for the cultivation of stalk celery. The content of some radionuclides in the soil was determined for the use of various forms of hydrogel in different depths of the soil.

The data of biometric parameters of stalk celery plants under the influence of hydrogel in the form of gel, tablets and granules was proposed. In particular, the height of the plants and the diameter of the stalks in the varieties Monarch, Anita and Diamant had a greater effect on granules and gel, while a significant increase in leaf area occurred under the action of tablets and granules. It was established that the use of the gel significantly increased the mass of the aboveground part of stalk celery plants.

The largest commodity yield was obtained under the use of gel: the Anita variety-43.5 t / ha, which exceeds the control for 10.8 t / ha; the Diamant variety-39.8 t / ha (+7.1 t / ha); the Monarch's variety-36.8 t / ha (+4.1 t / ha). The content of some indicators of the chemical composition of commercial green varieties of stalk celery depending on the use of different forms of hydrogel was determined as well. It was established that different forms of hydrogel in the studied varieties influenced the change in the biochemical composition of the commercial green of stalk celery differently.

Keywords: Soil; radionuclides; isotopes; radioactive contamination; cesium-137; strontium -90; γ-; β-radiation; vegetables; root celery; hydrogel

Formulation of the problem

Providing the population with quality ecologically safe food products, including those with a minimum content of radionuclides, has always been a priority of the state policy of Ukraine. In conditions of environmental degradation, when the negative impact of the environment increases, vegetables in particular contribute to the maintenance of human health and increase the body's immunity. Vegetables are valued not only for the content of nutrients and chemical elements in them, but also for the promotion of better assimilation of other foods.

One of the important factors substantiating the vegetable plant growth in a particular region is the conformity of the whole range of ecological requirements which includes the status and quality of soil, drugs that improve it and biological characteristics of plants etc.

Farmlands in Ukraine occupy the greater part of its territory - 67.4% of the total area of the country or about 407.1 thousand km^2, of which almost 11 thousand km^2 are contaminated with cesium-137 above 1 Ki / km^2 (Ivanov E.A., 2004, FAOSTAT 2015). Cherkasy region radioactive contamination after the Chernobyl tragedy was 6180 km^2. Most of the discarded radionuclides were isotopes of iodine-131, 132, 133, 135, barium and lanthanum-140, neptunium-239, which are called short-lived. They all disappeared as a result of natural disintegration during the first months after the disaster. Today, the so-called long-lived radionuclides are the most dangerous: cesium-137 (Cs-137), strontium-90 (Sr-90) and trans uranium elements (Mashchenko M.P., Mechov D.S., Murashko V.O., 1999).

There is a tendency for climate change to be more arid in Ukraine. The moisture deficit from year to year becomes more perceivable for crops and vegetables in particular. Limited water resources have led to the need for moisture deficit replenishment of the soil through irrigation. However, due to high irrigation costs, an attempt was made to find a solution aimed at reducing water use. One of the ways to achieve this goal in vegetable growing is the introduction of polymeric substances into the soil, the so-called hydrogel. A characteristic feature of hydrogel is the accumulation of a significant amount of moisture and its gradual return to the plants. Due to the underdeveloped root system, vegetable plants need water, and in the case of its lack, their food organs accumulate harmful elements and have a worse quality of both fresh consumption and processing.

According to scientists' calculations, plants use only 10% of precipitation 20% seeping into underground water and 70% evaporating from the surface of the soil, which in the process of drying is covered with an airtight crust. This problem can also be solved by applying a hydrogel (Guidelines for the conduct of tests for distinctness, uniformity and stability of Celeriac (Apiumgraveolens L. var. Rapaceum (Mill.) Gaud.), 2006, E. Kosterna, A. Zaniewicz-Bajkowska, R. Rosa, J. Franczuk, 2012).

Hydrogel - a specially designed substance for introduction into the soil in the form of granules. The granules of hydrogel diminish in size, forming the voids in the soil, thereby improving aeration. Due to this property, the physical characteristics of soil improve: clay soil becomes loose and granular soil becomes more structured (E. Kosterna, A. Zaniewicz-Bajkowska, R. Rosa, J. Franczuk, 2012).

Analysis of recent research and publications

Since 1991, on an annual basis, the authorities of the State Sanitary and Epidemiological Service have been conducting about 20 thousand radiological studies of water, soil, air and food products of plant and animal origin. In particular, more than 7,000 studies were carried out each year on the content of radionuclides in food raw materials of vegetable origin: vegetables, potatoes and melons (Samotuga, 2010, dosimetric passporting of Ukrainian points, 1992).

Recently, due to the economic crisis and the reorganization of the sanitary and epidemiological service in our country, the amount of radiological studies has decreased significantly. However, Cs-137 and Sr-90, which they can get from contaminated soils, remain quite dangerous radionuclides for plant products (Alekseev Yu.V., 1987, Report on the work, 2017, dosimetric certification, 1991).

The purpose of the work is to establish agroecological assessment, actual changes, to determine the influence of synthetic drugs, species and varieties on soil and vegetation pollution of Cherkasy region.

Research methodology

Radiological studies were carried out at the Laboratory of the Cherkasy Regional Laboratory Centre of the Ministry of Health of Ukraine on the spectrometer of γ-radiation energy for the scintillation SEG-001 "ACR-C"; determination of the content of cesium-137 (Cs-137), strontium-90 (Sr-90) -on the β-radiation spectrometer SEB-01. Studies using different forms of hydrogel for vegetable plants were conducted at Uman National University of Horticulture with stalk celery The study was performed according to the methodological guidelines in the field of vegetable growing and agrochemistry and included phenological observations, plant densities, and biometric measurements (Bondarenko, 2001); determination of pure productivity of photosynthesis - according to the formula of Williams and Watson (Nichiporovich, 1977); and determination of yield and quality of products. The chemical analysis of celery stalks was carried out during the third harvest in the phase of technical maturation. Defined content: dry matter and dry soluble substances (DSTU 7804: 2015), ascorbic acid (DSTU 7803: 2015), sugars (DSTU 4954: 2008), and nitrates (DSTU 4948: 2008). The extent of plants provision with nutrient elements was determined in samples of soil from layers 0-20 and 20-40 cm.

Research results.

Environmental monitoring over the last decade showed that the concentration of Cs-137 and Sr-90 in food raw materials and local consumption products has stabilized and amounted to 1-5 Bq / kg / l in the Cs-137 and to 1 Bq / kg / l in Sr- 90. Such levels of pollution are 10-100 times lower than the normative values. This trend has not changed until now [Report, 2017]. In Cherkassy oblast, where the density of Cs-137 was from 1 to 5 Ki / km^2, 103 settlements from 13 districts, including Kaniv (Trostyanets village) and Cherkasy (village Kumayki) (Table 1), were hit by radioactive contamination.

Table 1. Comparative analysis of cesium-137+CS-134 (Ci/km^2) content in soils of Cherkasy oblast.

No	Region, village	1991	1992	2017
1	Kanivskyi Trostianets village	6.86	5.47	0
2	Umanskyi Yatranivka village	1.91	1.6	0
3	Cherkasy Kumayki village	2.71	2.71	0

Note: These cities had the highest levels of radioactive contamination in 1991-1992.

Radiological monitoring allows you to control the level of radionuclide contamination of water, air, soil, agricultural production, primarily of vegetables and potatoes. According to the results of radioecological studies of vegetable food products carried out by the Cherkasy Oblast Laboratory Center of the Ministry of Health of Ukraine, it has been established that 100 sanitary-chemical researches among 708 account for vegetables and potatoes (Table 2).

Table 2. The content of radionuclides in vegetables.

Vegetables	**Cherkassy region**				**Kanivsky region**				**Umansky region**			
	Cs-137 Bk/kg		**Sr-90 Bk/kg**		**Cs-137 Bk/kg**		**Sr-90 Bk/kg**		**Cs-137 Bk/kg**		**Sr-90 Bk/kg**	
	actually	**norm**	**actually**	**norm**	**actually**	**norm**	**actually**	**norm**	**actually**	**norm**	**actually**	**norm**
Winter garlic	2.6	40	0.62	20	2.71	40	0.65	20	-	-	-	20
Yellow onion	2.7	40	0.48	20	2.5	40	0.44	20	2.52	40	0.63	20
Celery	2.48	40	0.56	20	2.61	40	0.61	20	2.76	40	0.58	20
Carrot	2.54	40	0.42	20	2.68	40	0.54	20	2.62	40	0.44	20
White cabbage	2.83	40	0.46	20	3	40	0.6	20	2.91	40	0.59	20
Peas	2.42	40	0.63	20	2.72	40	0.7	20	3.1	40	0.61	20
Marrow-type pumpkin	2.8	40	0.49	20	2.9	40	0.53	20	2.84	40	0.57	20
Tomatoes	2.1	40	0.44	20	2.51	40	0.55	20	2.14	40	0.56	20
Parsley	2.6	40	0.51	20	2.7	40	0.56	20	2.9	40	0.66	20
Cucumber	2.65	40	0.49	20	3.2	40	0.65	20	2.58	40	0.48	20
Pepper vegetable	2.4	40	0.7	20	2.6	40	0.8	20	2.44	40	0.72	20
Eggplant	2.7	40	0.69	20	2.84	40	0.75	20	2.64	40	0.64	20

The contents of the microelements in the maximum permissible amount are helpful for both plants and people however, the excess of their quantity in varying degrees is harmful. Therefore, it is important for vegetable plants to prevent the accumulation of heavy metals in products. The content of heavy metals in potatoes and vegetables was defined.
Consequently, the Cs-137 and Sr-90 concentration in vegetable products on the territory of the region did not exceed the indicators regulated by the hygienic norm "Permissible levels of radionuclides Cs-137 and Sr-90 content in food and drinking water". Out of the 37 samples of vegetable products and potatoes tested for the content of Cs-137 and Sr-90 the excess of the permissible norm was not found. Also, the excess of hygienic norms in soils taken for research from Cherkasy oblast : Kaniv, Uman and Cherkasy regions was not registered (Table 3).

Table 3. The content of radionuclides in the soil, depending on the form of hydrogel and the depth of sampling in the conditions of the Uman NPC.

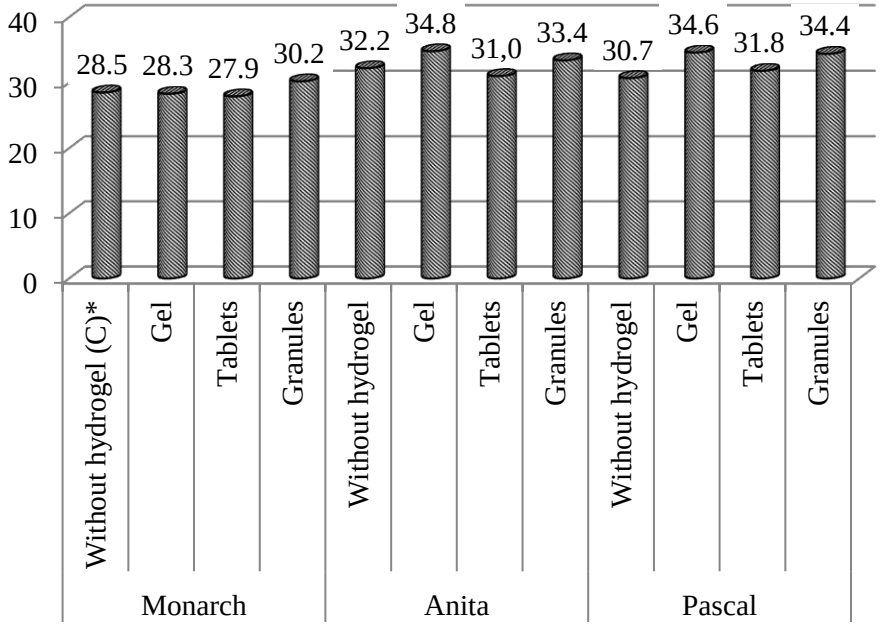
Form of Hydrogel	**A layer of soil, cm**	**The concentration of radionuclides in soil**					
		Cs-137	**K-40**	**Ra-226**	**Th-232**	**Norm by NTD**	**NTD on the research methods**
Gel	0-20	13.6	366	18	29	Not normalized	MVN 4/86 15-10-98
Gel	20-40	15.9	594	29	48	Not normalized	MVN 4/86 15-10-98
Granules	0-20	2.5	315	-	20	Not normalized	MVN 4/86 15-10-98
Granules	20-40	3.5	715	-	28	Not normalized	MVN 4/86 15-10-98
Tablets	0-20	6.0	651	-	50	Not normalized	MVN 4/86 15-10-98

Tablets	20-40	3.2	343	-	26	Not normalized	MVN 4/86 15-10-98
Control	0-20	4.7	345	-	33	Not normalized	MVN 4/86 15-10-98
Control	20-40	3.9	288	-	27	Not normalized	MVN 4/86 15-10-98

Note: control − without hydrogel, NTD – normative and technical documentation.

The results confirm the general tendency to stabilize the main radionuclides in soil and vegetable products. Actual figures for 20-100 levels are lower than the standard ones. These tables also indicate uneven radionuclide content depending on the form of hydrogel and the depth of soil sampling. The research has shown that the higher levels of radionuclides are observed in more structural soils and at a greater depth.

In order to determine the influence of species and varieties of vegetables and synthetic preparations reducing the amount of heavy metals in products, a study on celery was conducted. The influence of different forms of hydrogel on the growth and the development and productivity of stalk celery plants was established. Biometric measurements showed that the height of the celery plants varied from 27,9 to 34,8 cm, depending on the variety. The tendency to decrease the height of plants for the use of hydrogel in the form of tablets was observed. However the plants increased in height under the use of granules and gel (Figure 1).



SSD_{05}	A	1.8
	B	2
	AB	3.4

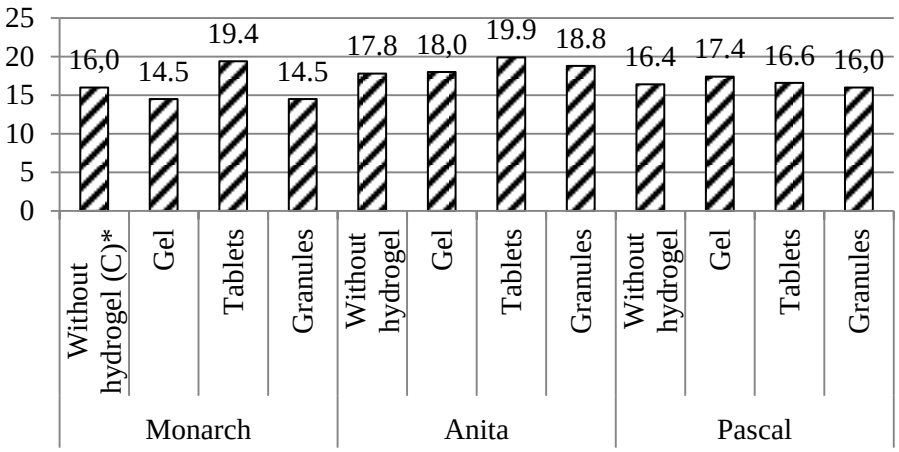
Figure 1. Celery petiole plant height, depending on the type and form of hydrogel, cm (average for 2015-2017).

The Monarch variety represented the best indicators for plant under the use of pellets-30.2 cm. On Anita variety the better reaction was for use of gel and pellets-34.8 cm and 33.4 cm, respectively. The Pascal variety represented the highest plant height under the use of gel and pellets-34.6 and 34.4 cm, respectively, and exceeded the control by 3.7-3.9 cm.
The diameter of the petiole somewhat varied in the varieties and forms of hydrogel (Figure 2). Thus, in the Monarch variety, the largest values for this indicator were for the introduction of gel and pellets-15.2 and 15.8 mm respectively. As for the Anita variety, the diameter of the petiole was larger than that of other varieties, and for the introduction of the gel, the rate corresponded to 16.2 mm, for the use of pellets-16.0 mm, which is greater than the control, 2.2 and 2.0 mm respectively. In the Pascal variety, the use of pellets and tablets contributed to the formation of a larger diameter of the petiole-15.4-15.6 mm, while the use of the gel led to its reduction (14.8 mm).

SSD_{05}	*A*	*0.9*
	B	*1.1*
	AB	*1.8*

Figure 2. The diameter of the celery petiole depending on the variety and form of the hydrogel, mm (average for 2015-2017).

Depending on the varietal characteristics of celery petiolate and under the influence of various forms of hydrogel, plants formed a different number of petioles (Figure 3).



SSD_{05}	*A*	*1.1*
	B	*1.3*
	AB	*1.9*

Figure 3. The amount of petioles per celery plant, depending on the variety and form of hydrogel, pc / plant (average for 2015-2017).

Monarch and Anita varieties produced the largest amount of petioles using tablets-19.4 and 19.8 units per plant, respectively, and 3.4 and 3.9 units respectively, which exceeds the control. A greater amount of petioles of the Pascal plant was formed for the introduction of gel into the soil -17.4 pcs./the plant, which is considerably more than control for 1.4 pcs.

In analysing the biometric parameters of plants, it can be noted that the use of hydrogel in its various forms increased the height of plants, diameter and amount of petioles in the studied celery. The height of the plants and the diameter of the celery petioles were more pronounced by the pellets and gel, while the amount of petioles increased for the application of tablet (Monarch, Anita) and gel (Pascal).

For a more complete assessment of the biometric indices of petiole celery, the leaf area and leaf index are used (Table 4). The determination of leaf area showed that in the Monarch variety, it was greater under the influence of tablets- 66.6 cm^2. In the

Anita variety, this indicator had lower values compared to the Monarch variety, but the use of granules showed the highest result- 61.4 cm^2. In the Pascal variety, a large area of leaves was formed under the use of pellets and tablets-63.3 and 63.4 cm^2/plant, respectively.

Calculating the total area of petiole celery leaves, depending on the variety and form of hydrogel before harvesting, it was shown that this indicator was higher in the Monarch variety for the introduction of tablets-16.9 thousand m^2 / ha, which significantly exceeded control by 1.8 thousand m^2 / ha. Smaller values of this indicator were in the Anita variety without the use of hydrogel and with the use of gel-13.3-13.4 thousand m^2 / ha. The Pascal variety among the experimental variants was distinguished by the most levelled data for this indicator-15.3-15.6 thousand m^2 / ha. However, a large area of leaves formed under the influence of tablets and pellets.

The leaf index shows the ratio of the leaf area size of all plants to the area of the soil on which they grow. In the studied varieties for the use of different forms of hydrogel, this indicator was within the range of 1.3-1.7, which indicates a slight overlap of the soil. The higher indicator was observed on the Monarch variety for the use of tablets-1.7. In the Anita variety without the use of hydrogel and the use of gel the leaf index was the lowest-1.3.

Table 4. Biometric indices of petiole celery plants before harvesting, depending on the grade and form of hydrogel (average for 2015-2017).

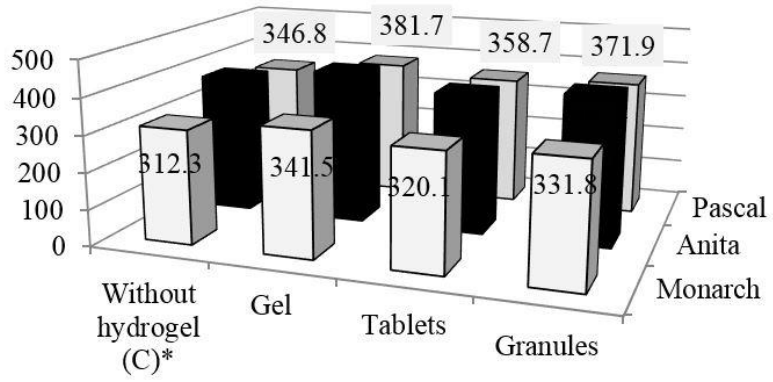
Variety (factor A)	**Hydrogel form (factor B)**	**Leaf area, sm^2/plant**	**thous. m^2/ha**	**Leaf index**
Monarch	Without-hydrogel (C)*	62.2	15.1	1.5
	Gel	62.6	15.4	1.5
	Tablets	66.6	16.9	1.7
	Granules	61.1	14.9	1.5
Anita	Without -hydrogel	55.5	13.3	1.3
	Gel	57.6	13.4	1.3
	Tablets	60.7	14.1	1.4
	Granules	61.4	15	1.5
Pascal	Without -hydrogel	62.2	15.3	1.5
	Gel	62.7	15.4	1.5
	Tablets	63.4	15.6	1.6
	Granules	63.3	15.6	1.6
SSD_{05}	factor A	1.9	1.1	–
	factor B	2.2	1.3	
	interaction of factors AB	3.8	2	

Notice: K*-control (non-hydrogel).

The Index of net photosynthetic performance represents the real possibility of agrobiocenosis for the synthesis of organic matter. It is one of the most important parameters which correlates the level of yields. NET photosynthetic performance shows the intensity of the formation of the dry weight of the plants of celery per unit time. The analysis of the data shows that the form-Hydrogel will influence the rate of net productivity of photosynthesis. The higher figures were obtained using gel and pellets: Monarch-1.5-1.9 g/m^2 /day, Anita-1.8-2.1 g/m^2 /day, Pascal-1.8-2.0 g/m^2 /day. With the use of tablets and the absence of hydrogel, the growth of dry weight of plants decreased. It was established that the use of different forms of hydrogel in the cultivation of petiole celery, greatly affects the mass of one plant and the overall yield. The mass of the aboveground part of the celery petiole had some discrepancies in the varieties and variants of the experiment. Thus, in the Monarch variety, the weight of the plant was greater with use of gel-341.5 g, which is significantly 29.2 g higher than the control. On account of the varietal features of the Anita variety, a larger mass of the aboveground part was formed. However, for the use of gel, the indicator was the highest-417.6 g, which significantly exceeded the control by 105.3 g. The Diamant variety presented higher values for this indicator using a gel-3810.7 g, which was 69.4 g higher than the control (Figure 4).

The datafor the crop yield of celery petiole varieties for the influence of various forms of hydrogel showed that higher yields were observed in all studied varieties for the use of hydrogel in the form of a gel. Thus, in the Monarch variety, for the use of hydrogel in the form of a gel, the yield was 36.8 t/ha, which is 4.1 tons/ha higher in comparison with the control, the Anita variety-43.5 t/ha (+10.8 t/ha than the control), and the Pascal variety-39.8 t/ha (+7.1 t/ha than the control) (Table 5).

A slightly lower yield was obtained for the use of pellets in the form of hydrogel. In the Monarch, it reached the level of 36.1 t/ha, Anita and Pascal sorted 41.6 and 39.1 t/ha respectively, which resulted in a substantial increase in the quantity of celery petiole products, respectively, at 3.4, 8.9 and 6.4 t/ha in comparison with the control.



SSD_{05}	*A*	*14,1*
	B	*16,6*
	AB	*28,8*

Figure 4. Mass of over ground part of celery petiole depending on the type and form of hydrogel, g (average for 2015-17).

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The lowest commercial yield of celery petiole was obtained for the use of hydrogel in the form of tablets. Thus, in the Pascal and Anita varieties it was 38.1 and 39.9 t / ha respectively, which is significantly higher in comparison with the control for 5.0 and 7.0 t/ha, respectively. In the Monarch variety for the same variant of hydrogel application, the value of this indicator was 0.5 t/ha, which is lower in comparison with the control and corresponded to a level of 32.2 t/ha (SSD_{05}= 1.9).

Table 5. Commodity yield of celery petiole depending on the variety and form of hydrogel, t/ha (average for 2015-17 years).

Variety (factor A)	**Hydrogel form (factor B)**	**Production yield, t/ha**				**± to the control**
		2015	**2016**	**2017**	**Average for 2015–2017**	
Monarch	Without-hydrogel (C)*	27.4	36.6	34.2	32.7	0
	Gel	32.6	37.2	40.5	36.8	4.1
	Tablets	30.5	31.6	34.4	32.2	-0.5
	Granules	30.9	38.6	38.8	36.1	3.4
Anita	Without -hydrogel	32.2	41.9	38.9	37.7	5
	Gel	39.7	47.3	43.4	43.5	10.8
	Tablets	38.3	39.4	42.1	39.9	7.2
	Granules	36.8	45.5	42.5	41.6	8.9
Pascal	Without -hydrogel	28.6	39.4	37.6	35.2	2.5
	Gel	28.7	46.8	43.9	39.8	7.1
	Tablets	34.6	41.3	38.3	38.1	5.4
	Granules	36.2	39.8	41.2	39.1	6.4
SSD_{05}	factor A	1.7	1.4	1.9	-	
	factor B	1.9	1.6	2.2		
	interaction AB	3.3	2.7	3.8		

Note: K* – control.

It was proved that the factors had a different effect on celery petiole yield and factor A (variety) determined the value of commodity yield by 24.0%, factor B (hydrogel form) -by 28.0%, and the total effect of factors A and B influenced the value of commodity yields with a strength of 48.0% (Fig. 5).

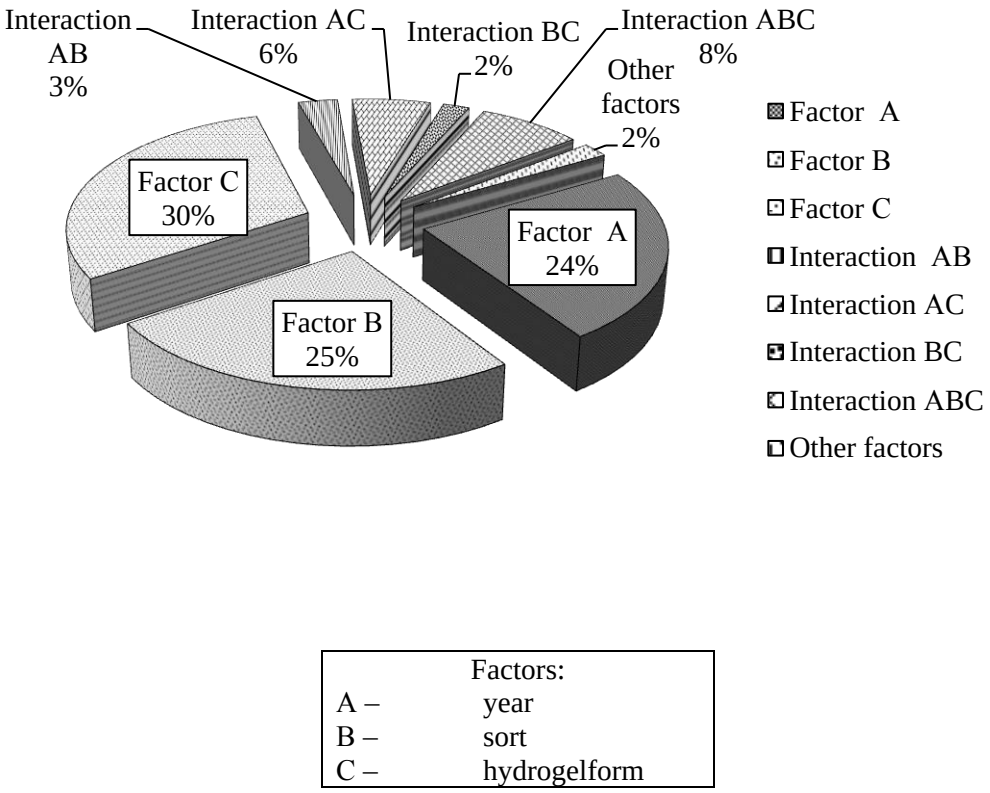

Figure 5. Influence of factors and their interaction on the formation of celery crop yield (average for 2015-2017).

It was established that the application of different forms of hydrogel influenced some indicators of the chemical composition of commercial greenery. The determination of the chemical composition of the green mass has been provided during 2015-2017 (Table 6). The content of dry soluble substances had certain differences in the experimental variants. Namely, the lower index was found in the control (without application of hydrogel)-12.9%. In other variants, the value of this indicator varied from 13.2% in the Anita variety for the use of tablets up to 14.8% for the use of gel. In each studied variety, the use of various forms of hydrogel contributed to the increase of dry soluble substances in commercial green plants. The highest growth was shown in the Monarch and Anita varieties upon gel application, and upon hydrogel in the form of tablets application for the Pascal variety.

Under the influence of hydrogel, the content of chlorophyll (a+c) varied. The lowest content was represented by the Anita variety without the use of hydro level and control variety- respectively 2.1 and 2.2 ml/l, while under the influence of various forms of hydrogel, the chlorophyll synthesis accelerated, resulting in its concentration in commodity greenery increased. The only exception is the Pascal variety, which represented reduction of the chlorophyll content for the use of different forms of hydrogel.

The content of the amount of sugars varies insignificantly (2.4-2.8%). In the Monarch variety, all forms of hydrogel contributed to the increase of sugars in the content for 0.2-0.3%, compared with the control. Alternatively, for the application of hydrogel on the Anita variety the reduction of the sugar content in celery greens for 0.2-0.3% was observed. In the Pascal variety, the increase in the content of sugars was only provided by hydrogel in the form of a gel-2.8%, which exceeds the control by 0.3%.

Table 6. Content of some indicators of the chemical composition of celery commercial green depending on the variety and form of hydrogel (average for 2015-2017).

Variety (factor A)	Hydrogel form (factor B)	Content Dry soluble substances, %	chlorophyll, (a+в), ml/l	sugars %	Vitamin C, mg/100 г	Essential oils, %
Monarch	Without -hydrogel (C)*	12.9	2.2	2.5	121.4	1.41
	Gel	14.4	2.5	2.7	130.1	1.5
	Tablets	13.8	2.3	2.8	123.6	1.42
	Granules	13.9	2.6	2.7	134.6	1.44
Anita	Without -hydrogel	13.6	2.1	2.8	127.1	1.48
	Gel	14.8	2.6	2.6	132.4	1.56
	Tablets	13.2	2.4	2.4	131.3	1.51
	Granules	14.1	2.6	2.6	128.9	1.54

Diamant	Without -hydrogel	13.4	2.7	2.6	130.1	1.47
	Gel	14	2.5	2.8	131.4	1.49
	Tablets	14.2	2.6	2.4	127.5	1.45
	Granules	13.7	2.6	2.6	132.5	1.41

Note: K* – control.

The application of different forms of hydrogel on the studied varieties contributed to the increase in the content of vitamin C, except for only the hydrogel in the form of tablets in the Pascal variety-127.5 mg/100 g, which is 2.6 mg/100 g less than the variant without the use of hydrogel in the same variety.

The content of essential oils in the market share of celery petiole ranged from 1.41 to 1.56%. In all studied varieties, the use of hydrogel in the form of gel increased the content of essential oils. The highest content observed in the Anita variety for the application of gel was 1.56%.

Conclusions. It was established that the level of soil and vegetable radionuclide contamination in Cherkasy region does not exceed the permissible norms and in fact is 20-100 times less compared with the 1990s of the last century. It was investigated that contamination with radionuclides depends on the structure of the soil, the depth of sampling and other factors, in particular pH, agrotechnics. Indicators of radionuclide content over the past decade are stable and are common to all areas of the region. Given the cumulative properties of individual radionuclides, this problem should remain the focus of State authorities.

The improvement of the soil due to the introduction of hydrogel showed that the use of different forms of hydrogel improves the biometric indices of celery plants of the studied varieties; increasing the mass of the aboveground part and crop yield.

It was established that the largest commodity yield of celery varieties was obtained for the application of hydrogel in the form of a gel: the Anita variety-43.5 t/ha, which is more than the control by 10.8 t/ha; in the Diamant variety-39.8 t/ha (+7.1 t/ha); in the Monarch's variety-36.8 t/ha (+4.1 t/ha).

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