PHYSICAL AND CHEMICAL INDICATORS AND MERCHANDASING ASSESSMENT OF WILD STRAWBERRY, GOOSEBERRY, CHERRY, RASPBERRY, BANANA, WILD ROSE AND KIWI

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Abstract: The fruit and berry vegetable raw materials applied in food production technologies have a positive impact on the consumer properties of ready-made product. The qualitative composition and the quantitative content of separate elements in fruit and berry raw materials have been studied in the work (wild strawberry, gooseberry, cherry, raspberry, banana, wild rose and kiwi). The studied samples conformed to the requirements of standards in appearance, coloring, taste and smell. Physical and chemical indicators, such as the content of solids, sugars, pectinaceous substances, organic acids, the titrable acidity of the crude and processed fruit and berry raw materials have been defined. It has been established that the highest quantity of carbohydrates, including sucrose, is in bananas, the lowest quantity is in raspberry. There is no sucrose in wild strawberry and wild rose. Cellulose is in all fruit and berry raw materials, its highest content is in raspberry. Pectinaceous substances are mainly in gooseberry. It has been established that all fruit and berry raw materials are rich with organic acids, except bananas. Apple acid is the only that prevails in bananas. At the same time the acidity of bananas is low. The titrable acidity of wild strawberry is the highest which is proved by the fact of lack of sucrose in it. It has been shown that fruit and berry raw materials contain such vitamins as B_1, B_2, B_6, PP, β-carotene, K_1, E and C. The greatest amount of vitamin C is in wild rose, there are also a lot of group B vitamins in wild rose, tocopherols prevail in wild rose and gooseberry. All types of fruit and berry raw materials are rich with major macro - and microelements. It follows from the obtained data that the physical and chemical indicators can not be the objective criteria of identification of the crude and processed fruit and berry raw materials as their values for different types of raw materials are very close, and sometimes they coincide. Some indicators, such as the content of vitamin C and total of carotinoids can indirectly be suitable for the identification of group of fruit and berry raw materials, but they do not allow to define a type of fruit and berry raw materials.

Keywords: Fruit and berry raw materials, quality, organoleptic properties, physical and chemical properties, identification

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INTRODUCTION

The fruit and berry vegetable raw materials applied in food production technologies have a positive impact on the consumer properties of ready-made product. In particular, it favorably affects the organoleptic characteristics of finished goods: taste, aroma and color. At the same time the vegetable components play a role of natural dyes and fragrances. Thanks to the presence of biologically active agents, fruit and berry vegetable raw materials have a good effect on the human body [1, 2].

Merchandising characteristics of fruit and berry raw materials: the high nutrition and biological value, the simplicity in the preparation for production, the wide range of fruits and berries and their derived products allow to use them effectively in various food technologies, including dairy products technologies [3].

The studied fruits and berries as vegetable objects with the prevalence of water in their composition have no high caloric value: 100 g of the edible part give only 30–100 kcal [4]. Easily digested carbohydrates prevailing in the dry weight are the main energy-yielding material in the composition of fruits and berries. Fruits and berries are of the highest value in nutrition as a source of biologically active agents - vitamins, macro- and microelements, specific substances and food fibers. Thanks to the presence of the listed groups of compounds, fruits and berries improve digestion, the activity of cardiovascular system, the neuroemotional state of the person, therefore a lot of fruits and berries are irreplaceable in nutrition. The average annual need of the person for fruits and berries is 7 kg. [4].

Fruits and berries, first of all, are an effective source of various carbohydrates among which there are sugars, polyols, pectinaceous substances, cellulose and hemicellulose. Sugars are digestible carbohydrates – glucose, fructose, sucrose because of a sweet taste inherent in them. The total content of sugars is from 1.0 to 20% [5, 6, 7]. Monosugars, glucose and fructose prevail. Their content is approximately equal in a lot of fruits and berries. The amount of sucrose (disaccharide) does not exceed 1% in the majority of them. Fructose – the sweetest and most dietary valuable sugar which is expedient for use in the diets with a low caloric content, and also in the food of children and diabetics prevails in the composition of raspberry. Pectinaceous substances and cellulose are carbohydrate polymers, they are not digestible for the human body, but their physiological role is high enough. Pectinaceous substances are part of cells and noncellular clusters. These are derivatives of galacturonic acid. There is soluble pectin and insoluble pectin (protopectin) [8, 9]. The ratio between soluble pectin and protopectin in the composition of fruits and berries changes in the course of growth, maturing and storage. Therefore, changes of consistence become noticeable as well. The content of pectinaceous substances with high jellifying properties which are shown at a certain ratio of pectinaceous substances, sugar and acids [10] in fruits and berries is 0.2–1.8%.

The purpose of work consisted in the determination of parameters of quality of fruit and berry raw materials. The study problems included the determination of titrable acidity, content of vitamins and minerals and also toxic components in fruit and berry raw materials.

OBJECTS AND METHODS OF STUDY

In accordance with the purpose and tasks of the work, the study objects were the following:

– fruit and berry raw materials:

Rubus idaeus (raspberry, the grade “Nagrada”),

Fragaria vesca (remontant wild strawberry, the grade “Berdskaya rannyaya”),

Ribesúva-crispa (garden gooseberry, the grade “Kooperator”),

Prunus fruticosa (ground cherry, the grade “Altayskaya lastochka”),

*Rosa majalis Herrm (*cinnamon rose*)*,

Actinidia deliciosa (kiwi delicatessen),

Músa paradisiaca (banana of "extra" grade);

– model fruit and berry mixtures.

All fruit raw materials used in the work were studied upon the organoleptic and physical and chemical indicators of quality according to the requirements of the relevant normative documents.

The test specimens were selected in accordance with GOST 26313-84 "Products of fruit and vegetable processing. Acceptance rules and methods of sampling". The raw materials are mixed and the single samples are selected from different layers of a product by means of a scoop, a sampler, a siphon and so forth, weighing 100–500 g each. The number of single samples from each unit of transport packing must be not less than two. The total weight of specimen from each selected unit of transport packing must be from 0.3 to 3.0 kg depending on the weight of the product needed for the tests.

The fruits of raspberry were assessed for the compliance with the requirements of GOST R 54691-2011. The appearance, maturity degree, state, smell and taste of berries, the presence of the agricultural fruits and berries damaged by agricultural depredators, the rotten and spoiled berries are assessed in an organoleptic way [11, 12].

The indicators of quality of fruits of wild strawberry were assessed in accordance with GOST 6828-89. The appearance, maturity degree, taste and smell, the presence of the sick and damaged berries of wild strawberry are determined in an organoleptic way; the size of berries - by measuring to a precision of no more than 0.1 mm [13].

Each fraction was weighed. All weighings were performed to a precision of no more than 0.01 kg.

RESULTS AND DISCUSSION

Table 1 presents the carbohydrate composition of fruits and berries.

The analysis of tabular data allows to draw a conclusion that the highest quantity of carbohydrates, including sucrose, is in bananas and the lowest is in raspberry. There is no sucrose in wild strawberry and wild rose. Cellulose is in all fruit and berry raw materials, its highest content is in raspberry. Pectinaceous substances are mainly in gooseberry.

Table 2 presents the titrable acidity and qualitative composition of organic acids of the studied fruits and berries, Table 3 – the content of vitamins.

Fruits and berries are a source of the mineral substances playing an important role in metabolic processes. The total of mineral substances or ash in the composition is 0.2–0.54%. Macro-, micro- and ultramicroelements are found in the composition of ash.

Analyzing these tables, it is possible to note that all fruit and berry raw materials are rich with organic acids, except bananas. Apple acid is the only that prevails in bananas. At the same time the acidity of bananas is low. It is explained by the existence of a large amount of sucrose. The titrable acidity of wild strawberry is the highest which is proved by the fact of lack of sucrose in it.

The qualitative composition and the quantitative content of separate elements are different which is caused by their biological and specific features to accumulate elements, the provision of soils with available forms of elements. In some cases the mineral composition can facilitate the identification of products of processing and prove their naturalness, but is not an objective criterion of specific identification of fruit and berry raw materials.

It follows from the tabular data that fruit and berry raw materials contain such vitamins as B_1, B_2, B_6, PP, β-carotene, K_1, E and C. The greatest amount of vitamin C is in wild rose, there are also a lot of group B vitamins in wild rose, tocopherols prevail in wild rose and gooseberry.

Table 4 presents the content of mineral substances in the studied raw materials.

Analyzing Table 4 it is possible to draw a conclusion that all types of fruit and berry raw materials are rich with major macro - and microelements.

Table 1. Carbohydrate composition of fruits and berries, %

Type of raw materials	Sugars		Pectic substances	Fibre
	Total	Sucrose		
Wild strawberry	3.7–8.1	–	0.7–1.4	4.0
Raspberry	3.6–8.4	0.6	0.5–0.7	5.2
Gooseberry	5.2–13.5	0.3–0.87	3.64–11.0	2-3
Wild rose	8.0–20.0	–	1.8–2.7	4.0
Cherry	6–10.5	0.2–0.31	0.4–0.8	1.8
Bananas	16–19	2.39	–	1.7–2.2
Kiwi	7–7.8	0.3–0.5	0.4–0.45	3.8

Table 2. Titrable acidity and composition of organic acids

Type of raw materials	Titrable acidity, %	Qualitative composition of acids
Wild strawberry	1.6–2.0	Citric, apple, chlorogenic acids and their derivatives, coumaric, salicylic and cinchonic acid
Gooseberry	1.5–3.8	Citric, apple, tartaric, succinic and phosphoric acid
Raspberry	1.3–2.1	Citric, apple, formic, salicylic and chlorogenic acids
Wild rose	0.9–2.5	Apple acid, phenolic acids
Cherry	0.5–0.8	Chlorogenic, ellagic, citric, apple, cinchonic, succinic and salicylic acid
Bananas	0.3–0.4	Apple
Kiwi	0.6–0.8	Apple, citric, salicylic, chlorogenic acids and their derivatives

Table 3. Content of vitamins in fruits and berries, mg / 100g

Type of raw materials	Thiamine (B_1)	Riboflavin (B_2)	Folacin (B_6)	Niacin (PP)	β-Carotene	Phyllochinone (K_1)	Tocopherols (E)	Vitamin C
Wild strawberry	0.03	0.05	13–0.25	0.3	0.03	0.2–0.4	0.3–0.9	20–55
Gooseberry	0.01	0.02	0.03–0.26	0.1	0.7–1.0	0.3–1.0	1.0	Up to 110
Raspberry	0.02	0.05–0.06	0.15–0.32	0.3–0.6	0.2–0.7	0.3–0.6	0.3–0.6	27–93
Wild rose	0.05	0.33–0.88	0.1–0.25	0.6	2.0–2.6	0.6–1.2	1.0–8.8	670–3800
Cherry	0.03	0.03	0.05	0.5	0.1	–	0.3	15
Bananas	0.04	0.05	0.4	0.9	0.12	0.5	0.4	180
Kiwi	0.02	0.04	0.2	0.5	0.09	–	0.3	180

Table 4. Content of the most important minerals in the composition of fruits and berries, mg/kg

Type of berries and fruits	Potassium	Sodium	Calcium	Magnesium	Phosphorus	Iron	Manganese	Cobalt	Molyb-denum
Wild strawberry,	30.8–160	18.0–22.1	27.9	13–18	23–103.6	12.0–103	10–28	0.03–0.052	0.06–0.085
Gooseberry	260	23	22	9	28	0.8	0.45	–	12 mkg
Raspberry	24.9–220	23.4	37.1	12.4	37–88.9	16–69	5.2–25.8	0.06	0.004
Wild rose	23-51	5–6	16–28	6–8	13	24–115	2.2–2.4	–	–
Cherry	256	20	37	26	30	0.3–0.5	0.08	1 mkg	10 mkg
Bananas	380–384	28–31	7–8	40–42	26–28	0.6	0.27	–	–
Kiwi	300	5	40	25	30–34	0.6–0.8	0.19–0.21	1.0 mkg	10 mkg

Table 5 gives the indicators of quality.

As the tabular data show, the quality of the studied raspberry conforms to the requirements of GOST, the content of toxic elements in raspberry does not exceed the admissible level (Table 12), the samples of raspberries can be applied for further studies.

Table 6 provides data on gooseberry.

Analyzing Table 6, it has been established that the samples of gooseberry are typical in shape and coloring, the taste is sourish and sweet, peculiar to this grade, without a foreign smack.

The content of toxic elements in gooseberries did not exceed the admissible level (Table 12).

Table 7 provides data on wild strawberry.

Proceeding from the data of Table 7, it has been established that the samples of berries of wild strawberry are typical in appearance, coloring, taste and smell, and correspond to the high grade. The content of toxic elements does not exceed the admissible level (Table 12), the berries can be used for further tests.

Table 8 presents the indicators of quality of hips.

The tabular data testify that the samples of hips conform to the requirements of GOST for all the indicators and can be used for further tests. The content of toxic elements does not exceed the admissible level (Table 12).

Table 9 gives the indicators of quality of the cherry used for the studies.

Table 5. Indicators of quality of fruits of ***Rubus idaeus*** (raspberry**,** the grade "Nagrada"), n = 5

Name of the indicator	Characteristics and norms	
	in accordance with GOST	in fact
Appearance, size and structure	Aggregate fruits are rounded or cone-shaped complex stone fruits not stuck together in clumps. Consist of a large number (30–60) of separate, grown together stone fruits. The size of the fruit is from 7.5 to 12 mm. Separate small spherical or ellipse stone fruits, with a stone inside, that has a pitted surface	The fruits are rounded and spherical, not stuck together in clumps. Consist of separate stone fruits grown together (48–60). The size of the fruit is from 9 to 17 mm. Meet the requirements.
Color of: surface pulp stones	Grayish and crimson Pinkish Dark yellow	Crimson red
Smell	Specific, pleasant	Pleasant, appropriate
Taste	Sourish and sweet	Mainly sweet
Moisture, %, not more than	15.0	13.0 $\pm$ 0.5
Mass fraction of total ash, %, not more than	3.5	1.5 $\pm$ 0.1
Mass fraction of the blackened fruits, %, not more than	8.0	4 $\pm$ 0.2
Mass fraction of the fruits stuck together in clumps, %, not more than	4.0	2 $\pm$ 0.5
Mass fraction of the fruits with unseparated pedicels and receptacles, %, not more than	2.0	0.5 $\pm$ 0.3
Mass fraction of the crushed particles of the fruits passing through a sieve with a diameter of openings of 2 mm, %, not more than	4.0	1.5 $\pm$ 0.5
Mass fraction of leaves and parts of raspberry stalks, %, not more than	0.5	0.0
Mass fraction of impurities, %, not more than		
organic (fruits and parts of other nonpoisonous plants)	0.5	0.0
mineral (ground, sand, stones)	0.5	0.0
Presence of poisonous plants and their parts	Not allowed	Absent
Presence of mold and decay	The same	Not detected
Presence of persistent foreign smell which does not vanish when ventilating	Not allowed	absent

Table 6. Indicators of quality of fruits of ***Ríbesúva-críspa*** (garden gooseberry, the grade "Kooperator"), n = 5

Name of the indicator	Characteristics and norms	
	in accordance with GOST	in fact
Appearance	The berries are quite developed, healthy, whole, pure, without mechanical damages, the damages caused by depredators and diseases, and excessive external moisture	The berries are mature, healthy, pure, without mechanical damages, depredators and diseases and excessive moisture.
Coloring	Homogeneous	Homogeneous
Taste and smell	Peculiar to the given pomological grade, without foreign smell and (or) taste	Sourish and sweet
Maturity	Harvest	Harvest
Content of berries of % of weight, not more than: Mechanically damaged: In places of shipment At destinations Slightly damaged by powdery mildew	 3.0 5.0 Not allowed	 1.5 ± 0.3 1.5 ± 0.2 absent
Vegetable impurities, % of weight, not more than	0.3	0.1 ± 0.05

Table 7. Indicators of quality of ***Fragaria*** (remontant wild strawberry**,** the grade "Berdskaya rannyaya"), n = 5

Name of the indicator	Characteristics and norms	
	in accordance with GOST	in fact
Appearance	The berries are quite developed, healthy, fresh, whole, mature, pure, without mechanical damages and excessive external moisture, with a pedicel or without it, but with a cup. Separate berries without a cup are allowed	The berries are developed, healthy, whole, mature, pure, without mechanical damages and excessive moisture, with a pedicel.
Taste and smell	Peculiar to the given pomological grade, without a foreign smell and (or) taste	Peculiar, without foreign smells and tastes
Coloring of berries	Homogeneous	homogeneous
Maturity	The berries are uniform in maturity	
Size to the largest cross-section diameter, mm, not less than:		
for fresh consumption	25.0	29 ± 0.5
for industrial processing	25.0 (high grade) Not rated (first grade)	–
Content of berries, % of weight, not more than: mechanically damaged		
in places of shipment	2.0 (high grade) 5.0 (first grade)	1.0 ± 0.2
at destinations	5.0 (high grade) 10.0 (first grade)	1.5 ± 0.5
damaged by depredators and birds	2.0 (high grade) 3.0 (first grade)	1.0 ± 0.1

Table 8. Indicators of quality of fruits of *Rosa majalis Herrm* (cinnamon rose), n = 5

Name of the indicator	Characteristics and norm for the raw materials	
	used as a medicinal preparation in the food industry as well	in fact
Appearance	The whole false fruits of various shape cleared of sepals and pedicels: from spherical, ovoid or oval to strongly extended spindle-shaped; the length of fruits is 0.7–3 cm, the diameter is 0.6–1.7 cm. There is a small round opening or a pentagonal platform on top of the fruit. Fruits consist of the overgrown receptacle (hypanthium) and numerous fruitlets (nutlets) enclosed in its cavity. The fruit walls are dense, fragile, the external surface is glossy, more rarely mat, more or less savoyed. The fruits are thickly covered inside with long and very stiff bristly hairs. The nutlets are small, oblong, with poorly prominent sides.	Whole, pure, from the spherical to the oval shape, the length of fruits is 1.8–3.2 cm, the diameter is 0.8–1.8 cm. There is a round opening on top of the fruit, the fruits consist of hypanthium and the fruitlets (nutlets) enclosed in its cavity. The walls are dense, the external surface is glossy and savoyed. The fruits are covered inside with long stiff bristly hairs. The nutlets are small, oblong, with poorly prominent sides.
Color:		
fruits	From orange-red to brownish-red	Orange-red
nutlets	Light yellow, sometimes brownish	Light yellow
Smell	Peculiar to the given raw materials, without foreign smells	Peculiar, without a foreign smell
Taste	Sourish and sweet, slightly astringent	Slightly astringent, sourish and sweet
Moisture, %, not more than	15.0	12 $\pm$ 0.5
Mass fraction of ascorbic acid, %, not less than	0.2	0.4 $\pm$ 0.01
Mass fraction of total ash, %, not more than	3.0	1.0 $\pm$ 0.1
Mass fraction of other parts of the plant (pieces of branches, leaves, sepals and pedicels), %, not more than	2.0	0.5 $\pm$ 0.1
Mass fraction of the blackened and burnt fruits and the fruits damaged by depredators and diseases, %, not more than	1.0	0,3 $\pm$ 0,1
Mass fraction of the crushed particles of fruits, including the nutlets passing through a sieve in accordance with TU 23.2.2068 with the openings with a diameter of 3 mm, %, not more than	3.0	1.0 $\pm$ 0.5
Mass fraction of immature fruits (from the green to yellow coloring), %, not more than	5.0	1.0 $\pm$ 0.5
Mass fraction of impurities: organic (parts of other nonpoisonous plants), %, not more than	0.5	absent
mineral (ground, sand, stones), %, not more than	0.5	absent

Table 9. Indicators of quality of ***Prunus fruticosa*** (ground cherry, the grade "Altayskaya lastochka"), n = 5

Name of the indicator	Characteristics and norms	
	in accordance with GOST	in fact
Appearance	The fruits typical for this pomological grade (first) in shape and coloring. The fruits typical and untypical for this pomological grade (second) in shape and coloring.	The fruits are typical for this pomological grade in shape and coloring.
Maturity	The fruits uniform in maturity, but not green and not overmature (first grade) The fruits are not uniform in maturity, but not green and not overmature are allowed (second grade)	The fruits are uniform in maturity
Size to the largest cross-section diameter, mm, not less than:	15 (first grade) Not rated (second)	17 ± 0.5
including that for small-fruited grades (Vladimirskaya, Samarkandskaya, Rastun'ya, Kartulialubali, Shubinka) and also that for ground and Nanking cherry	12 (first grade) Not rated (second)	–

Analyzing the data of Table 9, it has been established that the samples of cherry correspond to the first market grade upon the quality indicators, have a typical shape and coloring, the content of toxic elements does not exceed the admissible level (Table 12).

Table 10 gives the indicators of quality of the bananas used for further studies. Mature bananas, i.e. that of the harvest degree of maturity, of extra grade, produced in Ecuador have been studied.

The analysis of tabular data testifies that the samples of bananas correspond to the market extra grade, the content of toxic elements does not exceed the admissible level (Table 12).

Table 11 presents the indicators of quality of the studied fruits of kiwi.

It follows from the tabular data that the samples of kiwi are high-grade and can be used for further studies. The content of toxic elements does not exceed the admissible level (Table 12).

The analysis of tabular data testifies that the quality of the studied types of fruit and berry raw materials conforms to the requirements of normative documents according to the content of toxic elements and can be applied for further tests and the determination of specific identification.

The performed assessment of quality of fruit and berry raw materials with the application of organoleptic and physical and chemical methods of analysis provided by the existing normative documents has shown that the organoleptic method of assessment is the most acceptable for the purpose of identification of fresh fruits and berries. In case of the processed raw materials this method is subjective and is based only on the definition of taste, aroma and color of the applied vegetable raw materials which can be imitated by means of nutritional supplements - dyes and fragrances [14].

The physical and chemical indicators, such as the content of solids, sugars, pectinaceous substances, organic acids and titrable acidity can not be the objective criteria of identification of the crude and processed fruit and berry raw materials as their values are very close, and sometimes coincide in different types of raw materials. Some indicators, such as the content of vitamin C and total of carotinoids can indirectly be suitable for the identification of group of fruit and berry raw materials, but they do not allow to define a type of fruit and berry raw materials [15, 16].

Some physical and chemical methods, for example IR-spectrometry, allows to identify fresh fruit and berry raw materials and to establish the fact of availability of fruit and berry raw materials in foodstuffs, but does not allow to reveal theis species [17].

Thus, the performed studies on the assessment of quality of the fresh and processed fruit and berry raw materials have shown that the organoleptic and physical and chemical methods of analysis regulated by the existing regulatory system have limited capacities in the assessment of species of raw materials.

Table 10. Indicators of quality of *Músa paradisiaca* (banana of "Extra" grade), n = 5

Name of the indicator	Characteristics and norm		
	for the grades		in fact
	extra	first	
Appearance	The fruits are of the same pomological grade. The fruits in brushes are dense, fresh, pure, whole, healthy, developed, not miss-shaped, without flower remains, with highly prominent ridge sides. The crown is green, its cutoffs are plain, smooth, healthy, not overdried		The fruits are of the same pomological grade. The fruits in brushes are dense, fresh, pure, whole, healthy, with highly prominent ridge sides. The crowns are green, their cutoffs are plain, smooth, not overdried
Taste and smell	A specific smell of ripe bananas, the taste is sweet, without a foreign smack and aroma		The taste is specific, sweet, without a foreign smack and aroma.
Maturity	When cutting fruits lacteal juice is well emitted. The fruits are of the harvest degree of maturity with a greenish-yellow or yellow skin but not overmature, dense, roundish, the pulp is creamy		When cutting fruits lacteal juice is well emitted. The fruits are of the harvest degree of maturity with a yellow skin, not overmature, dense, roundish, the pulp is creamy
Sizes of the fruits:			
to the largest cross-section diameter, cm	3.0–4.0		3.0 ± 0.3
in length, cm, not less than	20.0	19.0	21.0 ± 1.2
Quantity of fruits in a brush, pcs.	4–8	4–9	7 ± 1.0
Quantity of brushes per one packing unit, pcs.	15–18	14–18	17 ± 0.9
Content of bananas with deviations from the fixed sizes of no more than:			
to diameter by 0.5 cm, %, not more than	2.0	5.0	1.0 ± 0.2
in length by 1.0 cm, %, not more than	3.0	5.0	2.0 ± 0.7
The surface damages of skin without touching the pulp, mechanical damages and those caused by agricultural depredators on one fruit with the total area of, cm^2, not more than	1.0	2.0	0.5 ± 0.02
Content of fruits with latex streaks (spots), %, not more than:			
- in area not more than 10 cm^2	Not limited		0
- in area more than 10 cm^2	1.0	2.0	0
Content of the broken fruits, with a tear of skin at the pedicel, with deep cuts, strong pressings, skin cracks when the pulp is touched, affected with anthracnose, fusariosis, Sigatoka disease, decayed, rotten, soften, chilled to the 3-4th degree, frozen, mashed, with extensive damages caused by agricultural depredators (skin plagues, deep red spots of nesting of trips), overmature with a dark brown, black or spotty skin	Not allowed		absent

Table 11. *Beginning.* Indicators of quality of fruits of *Actinidia deliciosa* (kiwi delicious), n = 5

Name of the indicator	Characteristics and norm			
	for the market grades			in fact
	high	first	second	
Appearance	The fruits are fresh, whole, pure, healthy, dense, at the stage of market maturity, shaped enough, without a stalk, not overmature, without the damages caused by insect depredators and diseases, without excessive external moisture and shape and coloring typical for the pomological grade			The fruits are fresh, whole, pure, healthy, at the stage of market maturity, Without the damages caused by depredators and diseases, oval-shaped, green
	Slight surface defects of skin which do not affect the quality are allowed	Fruits with slight deficiencies in shape, but without outgrowths and deformations, slight coloring defects, slight skin defects the total area of which does not exceed 1 cm, with small traces from the removed label in the form of longitudinal lines, without hillocks are allowed	Deficiencies in shape, coloring, skin defects in the form of slight cicatrized cracks or scratched/torn off skin the total area of which does not exceed 2 cm, with more prominent traces from the removed label, with small hillocks and slight dents are allowed	
Smell and taste	Peculiar to the given pomological grade, without a foreign smell and taste			peculiar, without foreign
Internal structure	The pulp is dense, juicy and tough, without damages			The pulp is dense, juicy and tough, without damages
The ratio of the minimum diameter to the maximum diameter of the fruit measured in cross section, not less than	0.8	0.7	Not rated	1.0 ± 0.1
Mass of fruits, not less than	90.0	70.0	65.0	91 ± 2.5
Maturity degree	Homogeneous	Homogeneous	Homogeneous, the fruits are of non-uniform maturity, not overmature are allowed	homogeneous
Mass fraction of soluble solids, %, not less than	15.0			17.7 ± 0.8
Mass fraction of the fruits with deviations of more than 10% from the fixed weight, % of weight, not more than	Not allowed	5.0	10.0	–
Mass fraction of the fruits with slight deficiencies in shape and coloring, with slight dents, with small hillocks, %, not more than	Not allowed	5.0	10.0	1.0 ± 0.5
Mass fraction of the fruits with surface skin defects, the total area of which is not more than 1 cm, %, not more than	Not allowed	5.0	10.0	–

Table 11. *Ending.* Indicators of quality of fruits of *Actinidia deliciosa* (kiwi delicious), n = 5

Name of the indicator	Characteristics and norm			
	for the market grades			in fact
	high	first	second	
Mass fraction of the fruits with skin defects in the form of cicatrized cracks or scratched/ torn off skin, the total area of which is not more than 2 cm, %, not more than	Not allowed	Not allowed	5.0	–
Mass fraction of the faded, mushy, watery, overmature, moldy and decayed fruits and the fruits damaged by insect depredators , with mechanical damages, with the damaged pulp, with excessive external moisture, %, not more than	Not allowed			absent
Mass fraction of the fruits grown together, %, not more than	Not allowed			absent

Table 12. Content of toxic elements in berries and fruits

Raw materials	Name of the element			
	plumbum	arsenic	cadmium	mercury
Raspberry	0.023	less than 0.02	0.011	less than 0.00002
Gooseberry	0.029	less than 0.02	0.012	less than 0.00002
Wild strawberry	0.030	less than 0.02	0.013	less than 0.00002
Cherry	0.075	less than 0.04	less than 0.01	less than 0.00002
Wild rose	0.040	less than 0.04	less than 0.01	less than 0.00002
Bananas	0.030	less than 0.03	less than 0.005	less than 0.00002
Kiwi	0.030	less than 0.03	less than 0.005	less than 0.00002
Dichlorophenoxyacetic acid, mg/kg in accordance with SanPiN 2.3.2.1078-01	max. 0.4	max. 0.2	max. 0.03	max. 0.02

REFERENCES

1. Altukhov Yu.P. *Geneticheskie protsessy v populyatsiyakh* [Genetic processes in populations: a study guide]. Moscow: Akademkniga Publ., 2003. 431 p.
2. Biryukova V.A., Zaitsev V.S., Pankin A.A., et al. DNK-genotipirovanie kartofelya i ego dikorastushchikh sorodichei na osnove polimorfizma umerennykh povtornostei semeistva R173 [DNA genotyping of potato and its wild relatives based on polymorphism of moderate repeats of the family R173]. *Materialy Mezhdunarodnoy yubileynoy nauchno-prakticheskoy konferentsii "Nauchnyye Trudy"* [Materials of International jubilee scientific and practical conference "Proceedings"]. Minsk, 2003, Part 1, pp. 313.
3. Kil' V.I. and Gronin V.V. Geneticheskie marker chuvstvitel'nosti populyatsiy koloradskogo zhuka k transgennomu kartofelyu [Genetic markers of sensitivity of the Colorado potato beetle populations to transgenic potatoes]. *Nauka Kubani* [Kuban' Science], 2005, no. 4, pp. 126.

4. Komarova I.N. *Razrabotka PTsR–test–system dlya vidovoi identifikatsii i kolichestvennoi otsenki myasnogo syr'ya v sostave melkoizmel'chennykh polufabrikatov i gotovykh myasnykh produktov* [Development of PCR test systems for species identification and quantification of raw meat in of semi-finished and finely ground meat products]. Diss.Cand.Sci.(Eng.). Moscow, 2005.
5. Lewin B. *Genes*. New York: John Wiley and Sons, 1983. n. p. (Russ. ed.: Lewin B. *Geny*. Moscow: Mir Publ., 1987. 554 p.).
6. Palilova A.N., Urbanowich O.Yu., Dolmatovich T.V., et al. Poisk molekulyarnykh markerov ustoychivosti rasteniy kartofelya k virusnoy infektsii [Search for molecular markers of potato plant resistance to virus infection]. *Materialy Mezhdunarodnoy yubileynoy nauchno-prakticheskoy konferentsii "Nauchnyye trudy"* [Materials of International jubilee scientific and practical conference" Proceedings"]. Minsk, 2003, part 1, pp. 316.
7. Politov D.V. Primenenie molekulyarnykh markerov v lesnom khozyaistve dlya identifikatsii, inventarizatsii i otsenki geneticheskogo raznoobraziya lesnykh resursov [Application of molecular markers in forestry for identification, inventory and assessment of genetic diversity of forest resources]. *Lesokhozyaystvennaya informatsiya* [Forestry Information], 2008, no. 3–4, pp. 24–27.
8. Prosekov A.Yu. And Babich O.O. *Gennaya inzheneriya* [Genetic engineering: a tutorial]. Moscow: Redaktsiya zhurnala "Dostizheniya nauki i tekhniki APK", 2010. 216 p.
9. Prosekov A.Yu., Golubtsova Yu.V., and Shevyakova K.A. Effektivnost vidovoy identifikatsii [Influence of Technological Raw Food Treatment on the Effectiveness of Species Identification]. *Pishchevaya promyshlennost'* [Food processing industry], 2014, no. 6, pp. 8–10
10. Prosekov A.Yu. Theori and practice of prion protein analysis in food products. *Foods and Raw materials*, 2014, vol. 2, no. 2, pp. 106–120. DOI: 10.12737/5467.
11. Prosekov A.Yu., Babich O.O., and Bespomestnykh K.V. Identification of industrially important lactic acid bacteria in foodstuffs. *Foods and Raw Materials*, 2013, vol. 1, no. 2, pp. 42–45. DOI: 10.12737/2053.
12. Romanova O.V. *Identifikatsiya sortov kostochkovykh kul'tur s pomoshch'yu PTsR-analiza* [Identification of the varieties of stone fruit plants by PCR analysis]. Diss.Cand.Sci.(Agr.). Moscow, 2007.
13. Astakhova L., Babich O., Prosekov A., et al. Short chain fatty acids (SCFA) reprogram gene expression in human malignant epithelial and lymphoid cells. *PLoS ONE*, 2016, vol. 11, no. 7, e0154102. DOI: 10.1371/journal.pone.0154102.
14. Coyne V.E., James M.D., and Reid Sh.J. *Molecular biology techniques manual: standard PCR protocol*. 1994.
15. Fulcrand N., Cheynier V., Oszmianski J., and Moutounet M. An oxidized tartaric acid residue as a new bridge potentially competing with acetaldehyde in flavan-3-OL condensation. *Phytochemistry*, 1997, vol. 46, no. 2, pp. 223–227. DOI: 10.1016/S0031-9422(97)00276-8.
16. James S.A., Collins M.D., and Roberts I.N. Use of an rRNA internal transcribed spacer region to distinguish phylogenetically closely related species of the genera Zygosaccharomyces and Torulaspora. *International Journal of Bacteriology*, 1996, vol. 46, pp. 189.
17. Dyshlyuk L., Babich O., Belova D., and Prosekov A. Comparative analysis of physical and chemical properties of biodegradable edible films of various compositions. *Journal of food process engineering*, 2017, vol. 40, n/a, e12331. DOI: 10.1111/jfpe.12331.

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