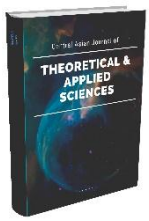

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Co-Authors of Article - Perspective Varieties of Red Cabbage for Repeated Culture in Uzbekistan

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Abstract: Perspective varieties of red cabbage for repeated culture in Uzbekistan. *The article presents the results of a study of a collection of 24 samples (2015), preliminary variety testing of 8 samples (2016-2017) and competitive variety testing of 5 samples (2018-2019). In variety tests, it was found that all tested variety samples belong to the most precocious is Omero F1, the least precocious of the Red Dinasty F1. For re-culture, a Ranchero F.*

Keywords: *planting, period of appearing of seedlings, age of the seedlings, ripening of head of cabbage, average mass, sheet, head of cabbage, productivity.*

Introduction. In recent years, in developed countries of the world, main attention has been paid to the organization of healthy nutrition. In many countries, the concepts of state policy and programs in the field of healthy nutrition of the population are being implemented, in which a great deal of attention is paid to the consumption of fresh vegetables in a wide range and throughout the year. It is generally accepted that vegetables are an irreplaceable source of a large number of biologically active substances, many of which are antioxidants that protect the body from oxidative stress, suppress the aging process and the development of many diseases. Therefore, it is widely believed that vegetables are not only food, but also medicine [6,7,9,11].

Much attention is paid to the organization of healthy food in Uzbekistan. The "Strategy for the Development of Agriculture of the Republic of Uzbekistan for 2020-2030", approved by the decree of the President of the Republic of Uzbekistan dated October 23, 2019 No. 5853, provides for the entire population with food and the promotion of a culture of healthy nutrition as a priority task [1]. This is also evidenced by the adoption by the Cabinet of Ministers of resolutions dated April 25, 2015 "On the further improvement of the implemented measures in the field of healthy nutrition of the population of the Republic of Uzbekistan" and dated August 29, 2015 "On the approval of the concept and a set of measures to ensure healthy nutrition of the population of the Republic of Uzbekistan for the period 2015-2020" [2].

In Uzbekistan, the production of vegetables significantly exceeds the consumption rates. However, the assortment of vegetable crops is not large (about 50 out of 1200 known) and requires a significant expansion.

An important role in the organization of healthy nutrition belongs to the consumption of vegetable plants of the Cabbage family, among which of great interest is red cabbage, which is widespread in the United States and many European countries, but is an unconventional crop for Uzbekistan.

Cabbage was introduced into cultivation more than 5 thousand years ago. Currently, there is a wide variety of cabbages in the world, which occupy more than 15 million hectares and are in 25th place among food crops [8,13,14,16].

All cabbage variety belongs to the Brassicaceae Burnet (Cruciferae Juss) family of Cabbage (Crucifers), genus Brassica L. According to the classification developed by T.V. Lizgunova (1984), all cultivated cabbage species are combined into one complex species Brassicaoleraceae L., which includes 5 species (white cabbage, Savoy, cauliflower, kohlrabi, leaf) and 3 varieties (red cabbage, broccoli, Brussels sprouts) Mediterranean-European and 2 species (Peking and Chinese) of East Asian origin [9,11].

In the literature there is a report on the presence of 5 species and 4 varieties of Mediterranean European and 3 species of East Asian origin. The ornamental variety Brassicaoleraceae is added to the first group. Convaracetela DS, and to the second - the Japanese species Brassicajaponica Sieb [4].

Currently, white and red cabbage are combined into one Brassicaoleraceae var. species. Capitata L., which has two forms: white (f. Alba) and red (f. rubra) [15].

Red cabbage was known in Europe even before our era. In the 17th century, she came from Europe to Russia. Currently, red cabbage is widespread in the USA, the Netherlands, Denmark, France, Russia, Ukraine, the Baltic states and many European countries. In Uzbekistan, it is considered an unconventional culture and does not yet have the proper distribution.

Red cabbage, a biennial plant. In terms of its morphological characteristics and biological properties, it is in many ways similar to white cabbage, but in comparison with it it develops more slowly and forms relatively small heads of cabbage, but very dense. It got its name by right. Its outer and inner leaves, due to the presence of anthocyanin, have a pronounced red color, sometimes reaching purple and violet hues.

Red cabbage is a cold-hardy, light-loving crop and is more heat-resistant than other types of cabbage. Its soil moisture requirements are higher than those of white cabbage. It is less damaged by pests. The technology of growing and harvesting red cabbage is the same as that of white cabbage. However, due to a more compact rosette, this crop can be planted somewhat denser [5].

The more valuable nutritional and therapeutic and prophylactic properties of red cabbage indicate its advantages over white cabbage and the need to expand the areas under it.

Red cabbage in Uzbekistan can be cultivated twice, in the spring-summer and summer-autumn periods, sharply differing in temperature conditions. In the first case, the growth of plants occurs with increasing temperatures, and the formation of heads of cabbage at high temperatures, and in the second, plants grow when the temperatures drop, and the formation of heads of cabbage coincides with the autumn cool weather.

Considering that in Uzbekistan at the end of June - beginning of July, more than 1 million hectares of irrigated land is freed from under grain crops and other crops, on which repeated crops can be grown, then a valuable property of red cabbage is suitable for cultivation in the summer-autumn period. ... In repeated cultivation, plants succeed better, the formation of the crop in which occurs in the cool autumn period. Red cabbage has just such properties.

It is known that the key to obtaining a high yield of any agricultural crop is the correct scientifically grounded choice of a variety or hybrid. In Uzbekistan, the selection of varieties of red cabbage has not been carried out and research in this direction has not been carried out.

Taking this into account, conducting research on the selection of varieties of red cabbage is an urgent scientific and practical problem. This prompted us to conduct research on the selection of varieties and hybrids of this crop when cultivating it in the summer-autumn period.

Conditions, materials and research methods. The research was carried out at the department of vegetable growing, melon growing and potato growing of the Tashkent State Agrarian University. Field experiments were carried out at the experimental base of the Research Institute of Plant Genetic Resources, which is located in Tashkent region Kibray district (41°2′ n.lat. and 69°2′ e.long.).

The climate of the flat part of the Tashkent region, where the field experiments were carried out, is characterized by a high level of solar radiation, continentality with significant temperature fluctuations in the daily and seasonal cycles, dry and hot summers, humid springs and unstable winters. The duration of sunshine is 2800-2900 hours per year (360-400 hours per month in summer and 90-100 hours in winter).

The average annual air temperature is +13...+14 °C. The average monthly temperature of the coldest month of January is -0,4…+1,5 °C, the hottest July is +27...+29 °C, the absolute minimum is -28...-35 °C, the absolute maximum is +43…+44 °C. Annual precipitation is 250-500 mm. Most of them are in the winter-spring period. Snow cover lasts an average of 25-70 days. The frost-free period lasts 220 days. The period with air temperatures above + 15 °C - 173 days (from April 14 to October 5). The sum of effective temperatures is above+15°C – 1310°C [3].

The weather conditions of the study period (2018-2019) in terms of temperature indicators were slightly higher than the average long-term.

Small deviations from the average annual indicators for temperature and precipitation were as follows:

In 2018, March was slightly warmer and more rainy than usual. In April, the middle of the month was more rainy, July and August were characterized by higher temperatures (table 1).

Table 1 Meteorological conditions of the period of field research according to the data of the "Ok Kawak" meteorological station

month	decades	Temperature of weather, ^{0}C				Annual precipitation, мм				Relative humidity, %			
		Average long-term	2017	2018	2019	Average long-term	2017	2018	2019	Average long-term	2017	2018	2019
April	1	13,05	10,8	13,3	15,5	24,03	25,4	23,6	35,0	73,25	63	76	77
	2	15,60	16,6	13,8	16,8	29,50	21,5	39,5	38,9	73,25	61	66	83
	3	16,43	16,4	19,1	13,2	20,48	13,9	10,3	56,4	73,00	60	62	85
average		15,00	14,6	15,4	15,1	71,25	60,8	73,4	129,3	73,25	61	68	82
May	1	19,48	20,6	19,4	19,8	12,18	35,2	1,8	1,9	63,5	59	65	65
	2	22,08	24,4	21,0	22,8	17,45	8,8	15,0	1,2	65,25	55	74	66
	3	22,78	25,8	20,8	22,7	4,35	8,2	8,9	0,3	60,5	51	65	63
average		21,38	23,3	20,4	21,8	33,98	52,2	25,7	03,4	63,25	55	68	65
June	1	23,60	23,5	24,5	22,3	4,08	1,4	1,9	13,0	64,25	47	66	72
	2	26,20	28,6	25,7	24,8	5,75	0	8,1	0	56,25	44	63	59
	3	27,53	27,2	27,3	28,8	0,03	0	0,1	0	52,5	42	54	57
average		25,75	26,4	25,8	25,3	9,85	1,4	10,1	13,0	57,75	44	61	63
July	1	29,45	31,6	30,0	28,9	0,25	0	0	0	52,25	43	44	61
	2	28,95	26,0	31,3	31,2	0,00	0	0	0	51,25	45	46	57
	3	28,65	30,4	28,0	29,0	0,15	0	0	0	54,75	45	48	63
average		28,50	26,7	29,7	30,3	0,40		0	0	52,5	44	46	60

August	1	28,40	29,2	28,6	29,3	0,33	1,3	0	0	58,25	48	51	67
	2	25,18	23,7	27,3	24,1	0,25	0	1,0	0	58,75	48	49	69
	3	24,20	25,6	22,3	25,1	0,00	0	0	0	58,75	49	50	68
average		25,90	26,1	26,1	26,1	0,58	1,3	1,0	0	58,5	48	50	68
September	1	21,78	25,5	20,9	18,6	0,00	0	0	0	62,5	48	52	75
	2	20,68	20,9	20,4	21,2	0,00	0	0	0	53,25	50	51	56
	3	18,78	16,0	20,1	21,1	4,60	12,6	0	0	60	50	54	68
average		20,40	20,8	20,5	20,3	4,60	12,6	0	0	58,75	49	54	66
October	1	16,98	17,6	15,7	18,6	13,50	2,8	29,8	0	63,25	54	65	67
	2	14,40	18,9	8,8	16,2	10,45	3,6	11,1	0	65,5	56	68	69
	3	14,80	17,5	14,9	15,1	6,33	4,3	12,2	0	66	59	61	72
average		15,38	18,0	13,1	16,6	28,65	10,7	53,7	0	64,75	57	64	69

In 2018, March was warmer and drier than usual, while April, on the contrary, was cooler and rainy. May was very dry. July and August were hotter, September was close to multiyear averages, and October was warmer than usual.

2019 was marked by a significant increase in temperatures. But October was also somewhat warmer than usual and without precipitation.

The relative air humidity during the entire study period was higher than the long-term average values. It increased with precipitation and decreased at high temperatures.

The soils of the plain zone of the Tashkent region are diverse in texture (from sandy loam to heavy loams), have a low absorption capacity and a high saturation with alkaline earth elements, and have a microstructure (Gafurova L.A., 2004).

The soils of the experimental base of the Research Institute of Plant Genetic Resources, where the experiments were carried out, are represented by typical gray soils of old irrigation with a humus layer thickness of 0.6-1.0 m, soils are carbonate-alkaline. The carbonate horizon lies at a depth of 50-60 cm. In terms of texture, they are medium loamy. Groundwater occurs at a depth of 7-8 m and has a good outflow. The soils are not saline.

The land plot where the experiments were located was characterized by a very low content of humus (0.86-1.07%), gross nitrogen (0.083-0.10%), gross phosphorus (0.092-0.12) and an average content of gross potassium (1 , 60-1.80%). The supply of mobile forms according to the existing classification was: nitrogen and phosphorus - low (11-27 and 18-37 mg / kg) and potassium - medium (200-250 mg / kg).

Results of studies. The research was carried out by setting up field experiments to study a collection of 24 varieties (2015), preliminary variety trials of 8 varieties (2016-2017) and competitive variety testing of 5 samples (2018-2019). The study of the collection was carried out without repetitions, the area of single-row plots was 5 m^2, variety trials - according to the methodology of the State variety testing in 4 replicates with an area of four-row plots - 16, 8 m2. Seedlings were planted in the ground in mid-July. At all stages of the study, a hybrid zoned in Uzbekistan served as the standard Primero F_1.

The collection studied 24 cultivars of red cabbage, of which 10 varieties (Toporani, Kolibos, Sizaya golubka, Without name from Chine, Without name from South Korea, Tsinzinpinyun, Raby Quin, Chourouge Gros, Cherno golova, Langedeyker) 14 hybrids (Primero, Rubin, Varna, Mars MS, Rondale, Ranchero, Romanov, Royal, Rococo, Super red, Red Dynasty, Benefis, Garance).

Based on the results of studying the collection in terms of setting and average weight of heads of cabbage, yield, the following varieties were identified: Red Dynasty F_1, Super red F_1, Without name from Chine,

Romanov F_1, Royal F_1. With standard and hybrid Omero F_1, which popular in seed market of Uzbekistan, they were included in a preliminary variety trial.

During the preliminary variety testing, it was revealed that all the varieties tested in it, according to the duration of the growing season, belong to the group of early varieties (from planting to the first harvest, 84-92 days). Among them, the fastest ripening was a hybrid Omero F_1. In this variety test, the largest number of leaves of the root rosette formed Ranchero F_1, a few - Omero F_1. The best set of heads of cabbage was distinguished variety Without name from Chine, a worst hybrids Royal F_1 and Super red F_1.

The largest heads of cabbage formed Without name from Chine, Ranchero F_1 and Red Dynasty F_1, smallest - Royal F_1 (table 2).

Table 2.

The number of leaves, setting and average weight of heads, total and marketable yield of red cabbage samples in preliminary variety testing at repeated cultivation

(2016-2017)

№	Samples	The number of leaves in one plant	Setting heads, %	Average weight of heads, kg	Total yield		Marketable yield		
					t/ha	% to st	2016	2017	% to st
1	Primero F_1, st	16,8	94,9	1,01	35,9	100	27,1	34,2	100
2	Ranchero F_1	18,2	90,7	1,17	44,39	123,6	38,05	40,2	128,0
3	Romanov F_1	17,5	86,4	1,0	29,32	81,6	22,6	24,02	73,0
4	Without name from Chine	17,3	96,3	1,20	45,76	127,1	42,0	37,05	129,1
5	Royal F_1	15,6	88,9	0,7	20,05	55,8	14,9	16,02	51,4
6	Red Dynasty F_1	17,6	90,6	1,14	42,2	117,3	35,1	35,02	114,4
7	Super red F_1	17,6	90,2	1,07	41,22	115,3	32,18	36,06	112,9
8	Omero F_1	14,9	92,4	1,01	38,01	105,9	28,32	37,34	107,1

It should be noted that the value of the total and marketable yield was directly proportional to the average weight of the head of cabbage. Therefore, the varieties that formed large heads of cabbage provided a higher yield.

The most productive, both in general and marketable yield, were in descending order: Without name from Chine, Ranchero F_1 и Red Dynasty F_1. Hybrids were significantly inferior to the standard in terms of total and marketable yield Romanov and especially - Royal F_1. These two hybrids and Super red F1 were not included in the competitive variety trial.

In the competitive variety trial, along with the standard, 4 samples were included: the three most productive and the Omero F_1 hybrid, which was distinguished by high set and marketability of heads.

During the competitive variety trials in determining the number of leaves, setting and average weight of heads of cabbage, the same results were obtained as in the preliminary variety trial. Most leafy were Ranchero F_1, Red Dynasty F_1 and Without name from Chine, least leafy were - Omero F_1. The best setting

heads were Without name from Chine, Omero F_1, more biggest heads formed Ranchero F_1 and Without name from Chine.

Revealed that the total harvest, in 2018 the hybrid Ranchero F_1 and Without name from Chine exceeded the standard by 2.0-2.4 t/ha. This did not exceed the LSD and was within the experimental error, hybrids Red Dynasty F_1 and Omero F_1 in terms of total yield were the same with the standard.

In 2019 Ranchero F_1 and Without name from Chine reliably exceeded the standard in terms of total yield. Hybrids Red Dynasty F_1 and Omero F_1, as in 2018, were formed the same harvest as the standard.

On average, over two years, the hybrid Ranchero F_1 and Without name from Chine showed better results than others in terms of total yield (table 3).

Table 3. Total and marketable yield of red cabbage samples in repeated cultivation

№	Samples	Total yield, t/ha				Marketable yield, t/ha			
		2018	2019	average	% to st	2018	2019	average	% to st
1	Primero F_1, st	38,3	37,6	38,0	100	33,7	26,1	29,9	100
2	Ranchero F_1	40,7	44,8	42,8	112,6	35,8	32,8	34,3	128,9
3	Without name from Chine	40,3	40,3	40,3	106,1	33,9	27,6	30,8	103,0
4	Red Dynasty F_1	37,7	36,3	37,0	97,4	33,1	25,6	29,4	98,3
5	Omero F_1	38,1	38,5	38,2	100,5	33,5	29,9	31,7	106,0
$S_{x\%}$		**0,45**	**0,25**						
Sd		**1,8**	**0,70**						
LSD_{05}		**2,6**	**1,4**						
$LSD_{05,\%}$		**1,2**	**0,6**						

By the size of the marketable crop, in addition to Ranchero F_1 and Without name from Chine, the hybrid Omero F_1 also stood out, which had a higher yield of marketable heads of the total crop mass.

The total and marketable yield in preliminary and competitive variety trials, it can be assumed that the Ranchero F_1, Omero F_1 hybrids and the Without name from Chine have higher yields than the standard, and the Red Dynasty F_1 hybrid forms the same yield as the standard.

The preliminary and competitive variety trials made it possible to draw the following **conclusions:**

1. The most of leafiest sample were Ranchero F_1, Without name from Chine and Red Dynasty F_1, the least was - Omero F_1.
2. The best setting of heads showed Without name from Chine and Omero F_1, the worst was - Red Dynasty F_1.
3. More largest heads of cabbage formed Ranchero F_1 and Without name from Chine, the smallest - Omero F_1.
4. Ranchero F_1, without name from Chine and Omero F_1 gave better results in total and marketable yields from standard.
5. For planting in repeated culture recommended Ranchero F_1 and Without name from Chine.

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