



## **SELECTION OF SWEET PEPPER VARIETIES SUITABLE FOR THE CULTIVATION IN SUMMER TIME AS A DOUBLE CROP IN CENTRAL REGIONS OF UZBEKISTAN, THEIR MORPHOLOGICAL INDICATIONS AND PRODUCTIVITY**

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### **ABSTRACT**

*The article outlines the results of investigations on morphological indications and productivity of 16 local and foreign varieties and hybrids of sweet pepper that was studied in double cropping period in the condition of central parts of Uzbekistan. Morphological indication of Zumrad variety of sweet pepper cultivated under double cropping period was 16% higher than other varieties. The productivity of Control Dar Tashkenta variety made 30,9 tons per ha and compared to it Yulduz, Shodlik, D11200, D08018 varieties showed 113,7-126,3% higher results. The highest productivity was observed in Adriatico F<sub>1</sub> and Pkocraft F<sub>1</sub> hybrids – 42,8-42,9 t/ha.*

**KEYWORDS:** *sweet pepper, double cropping period, variety, hybrid, morphology, productivity.*

### **INTRODUCTION**

Nowadays the pepper is regarded the most common vegetable in great demand in the world and the area under its cultivation makes 1,933 mln. hectare, average productivity per ha makes 16,1 tons, gross yield is 31,131mln. tons. China (15,823 mln.t), Mexico (2,294 mln.t), Turkey (2,159 mln.t), Indonesia (1,726 mln.t) have been leading countries in the world on pepper cultivation since several years [9].

Today the prior tasks on providing food security in the countries with continental natural climatic conditions are using effective agrotechnologies in the cultivation of sweet pepper as a double crop by utilizing current irrigated areas considering the regional climate and increasing the productivity of the crop and producing capacity of gross product.

Double crop cultivation system in summer time is well developed on the farms of the countries in South Europe, Central and South Asia, South America, Australia continents with warmy days and with continental climatic conditions. In order to meet the demand for sweet pepper, it is important for agricultural producers to conduct researches on improvement of cultivation technology of this crop as a second crop, determination of the most proper sowing time and feeding area of plant, selection of demandable and productive varieties and hybrids. Through implementing scientifically based technology high indications of economical efficiency from double crop can be provided for increasing production, using irrigated lands effectively.

Uzbekistan takes a leading place in Central Asia on the cultivation of vegetable, melon and potato crops.

The particular points of vegetable growing in our country are that there are opportunities to get the yield two or more times from the same field in one year and to produce the yield of most crops too early by using natural climatic conditions rationally and selecting properly vegetable crops as double crop. This opportunity allows to increase economical efficacy of farms nowadays. This sector is being supported regularly by the government [1, 4, 5].

Basing on the information presented in the literatures and on the experiment results of most researches conducted on the study of influence of one of main vegetable crops – sweet pepper varieties, their sowing time and scheme in various soil-climatic conditions on the productivity, the following opinions and ideas have been conveyed.

The data was presented in the catalogue of crop varieties which was elaborated in the countries of Central Asia and the Caucasus about farm valuable traits of 25 varieties of sweet pepper on the basis of former sources of the World Vegetable Growing Centre. For example, in Kazakhstan there are Bayan Sulu, Kozi Korpesh, Krasnoye chudo, Kaz-Tay varieties, in Kyrgyzstan 0636-6007, VIO3170, PP0636-6056, AVPP0408 lines, in Tajikistan AVPP0912, AVPP1115, VIO3217, AVPP0911, AVPP0108 lines, in Turkmenistan Nabat, in Uzbekistan Shodlik, Sabo, in Armenia Mili, Emili, Natali, Loshtak, Mira, Narij, in Georgia Tayvanuri, and in Azerbaijan Humay varieties. This catalogue includes the varieties such as Sabo, Narij, Emili, Natali, Bayan Sulu that take yellow colour when physiologically mature [3].

The first edition (2017) of State Register for the implementation of seed-breeding achievements in Russian Federation includes 742 varieties and hybrids of sweet pepper, and out of them 300 are F<sub>1</sub> hybrids and 442 are varieties. In 2017 21 F<sub>1</sub> hybrids and 19 varieties, total 40 varieties samples were allowed for sowing. To this register 94-95% of sweet pepper varieties and hybrids were entered only after 2000 during 17 years, and this means that the demand for sweet pepper and for its varieties, hybrids is increasing year by year [2].

In 2017 to State register on agricultural crops which are allowed for sowing in the territory of the Republic of Uzbekistan total 41 sweet pepper varieties and hybrids were included, out of them 8 are varieties and 33 are hybrids. 8 varieties and one hybrid from them were created in our country, 19 in Holland, 7 in France, 3 in Italy, 2 in Korea and one in Germany selection. In 2015 this list contained total 38, in 2016 3 new foreign hybrid was added to this list, so they became total 41 and in 2017 none of variety or hybrid was added to the list [6, 7, 8].

## MATERIALS AND METHODS

The research investigation was carried out in 2014-2016 in virgin soil areas of Tashkent region. «Methodics for conducting experiments on vegetable,

melon and potato growing», «Methodological instructions on the study and keeping of world collection of vegetable crops», «Methodics for state experiments on the sorts of agricultural crops» and other methods were used in the research experiment. Certainty and veracity of the obtained data were statistically analyzed by common multifactor method of B.A.Dospekhov.

## RESULTS AND DISCUSSION

Several scientists such as S. Norma (USA), G.S. Gikalo, V.A. Bukina, N.P. Bitkova (Russia), B.M. Amirov, J.S. Amirova (Kazakhstan), P.G. Djurov, M. Korabayev, V.O. Serkova, Sh.T. Mamadaliyev, T.K. Kholmuminov (Uzbekistan) made their contribution to wide scientific research works on the improvement of technology for sweet pepper production. However, the study of sweet pepper production as a double crop has been carried out for the first time by us.

In 2014-2016 testing experiments were conducted on the selection of suitable samples from 10 varieties and 6 F<sub>1</sub> hybrids of sweet pepper for sowing in double cropping. Consequently, Dar Tashkenta was selected for variety sample and Jaykhun F<sub>1</sub> was selected for standard variety and hybrids sample for the experiments.

Morphological indications of sweet pepper varieties and hybrids – the determination of the root, stalk-leaf weight, number and surface of leaves per plant was done.

Due to simple preparation of seedlings of sweet pepper varieties samples and hybrids, their roots are not strong enough to develop. Root weight of standard Dar Tashkenta variety was 47,5 g in this experiment and in standard Jaykhun F<sub>1</sub> hybrid it was 52,1 g, the difference between them showed 9,7%. Among 10 varieties 116,4% more root weight was observed only in Zumrad variety compared to standard variety.

The indication of the remaining varieties varied from 95,2 to 108,6% compared to standard Dar Tashkenta; and compared to standard Jaykhun F<sub>1</sub> hybrid from 96,4 to 107,1%. According to root system weight average indication was 49,2 g among varieties and 52,6 g in hybrids.

While in standard variety stalk-leaf weight was 275 g in one plant, in standard hybrid it was 296 g or 7,6% more than standard Dar Tashkenta variety. Among tested variety samples only Zumrad variety could have 112,3% more stalk-leaf weight compared to standard variety. This indication in other varieties was between 265-301 g or 96,6-109,4%. Compared to standard Jaykhun F<sub>1</sub> hybrid this indication of other hybrids was 98,4-107,8%. These indications are considered in the limit of experiment mistake (table-1).

Correlation connection between the root weight and stalk-leaf weight of one plant was strong ( $r=0,99\pm 0,04$ ).

**Table 1**  
**Morphological indications of sweet pepper varieties and hybrids (in 2014-2016)**

№	Varieties and hybrids	In one plant							
		Root weight (A)		Stalk-leaf weight (B)		Number of leaves (C)		Leaf surface (D)	
		g	%	g	%	pcs	%	dm <sup>2</sup>	%
1	Dar Tashkenta (st)	47,5	100,0	275	100,0	210	100,0	48	100,0
2	Zarya Vostoka	45,2	95,2	265	96,6	200	95,3	46	95,9
3	Zumrad	55,3	116,4	321	116,7	245	116,7	56	116,4
4	Tong	45,8	96,4	266	96,7	202	96,2	46	96,8
5	Sabo	50,6	106,5	293	106,4	225	106,9	52	107,6
6	Yulduz	51,4	108,2	298	108,3	228	108,7	52	108,4
7	Shodlik	49,5	104,2	289	105,0	220	104,5	50	105,2
8	PP 10676	46,8	98,5	273	99,2	207	98,6	48	99,6
9	D 11200	48,6	102,3	281	102,1	216	102,6	50	103,3
10	D 08018	51,6	108,6	301	109,4	221	105,3	51	106,9
11	Jaykhun F <sub>1</sub> (st)	52,1	100,0	296	100,0	229	100,0	48	100,0
12	Adriatico F <sub>1</sub>	55,8	107,1	319	107,8	246	107,5	53	110,1
13	Figaro F <sub>1</sub>	53,1	101,9	306	103,4	235	102,9	50	103,9
14	Vedrana F <sub>1</sub>	50,8	97,5	295	99,8	225	98,6	47	97,6
15	Dovras F <sub>1</sub>	50,2	96,4	291	98,4	220	96,4	47	96,9
16	Pkocraft F <sub>1</sub>	53,8	103,3	306	103,4	236	103,0	50	104,0
X	varieties	49,2	103,6	286	104,0	217	103,5	50	104,0
	hybrids	52,6	101,0	302	102,1	232	101,4	49	102,1
	r =	0,99 ± 0,04				0,75 ± 0,18			

Number of leaves was 210 pieces in one plant of standard variety, and only in Zumrad variety this indication was observed 116,7% more compared to standard one. Indication of the remaining varieties made 95,3-108,7% compared to standard Dar Tashkenta variety. In standard Jaykhun F<sub>1</sub> hybrid number of leaves made 229 pieces while in the remaining hybrids the indication was between 96,4-107,5% compared to it. Average number of leaves in varieties was 217 pieces and in hybrids it constituted 232 pieces, the difference showed 106,9%.

Leaf surface in one plant of standard Dar Tashkenta variety was 48 dm<sup>2</sup> and in comparison with it in Zumrad variety this indication was 116,4% more. The remaining varieties varied in this indication from 46 to 52 dm<sup>2</sup> or 95,9-108,4%. Compared to standard Jaykhun F<sub>1</sub> hybrid only in Adriatico F<sub>1</sub> hybrid the leaf surface was 110,1% higher.

The correlation connection between the number of leaves in one plant and surface of leaf is strong ( $r=0,75\pm 0,18$ ).

At the phase of whole technical maturation of fruits of varieties the number of fruits of standard Dar Tashkenta plant variety is 6,8 pieces and in Jaykhun F<sub>1</sub> hybrid it was 7,1 pieces. Compared to standard variety the number of fruits constituted 76,5% in Zumrad variety, in Sabo variety this indication was closer to standard variety (97,1%). The indication of the remaining varieties was a bit higher by the number of fruits. Compared to the standard one 110,3-114,7% indication was observed in Zarya Vostoka, Tong, Yulduz, Shodlik varieties; 117,6-122,1% indication in

PP10676, D11200, D08018 varieties. Less number of fruits was noted in F<sub>1</sub> Figaro compared to standard hybrid and the indication of the remaining hybrids showed 98,6-101,4%. By the number of fruits the average indication was 7,3 pieces in the varieties and 6,7 pieces in the hybrids (appendix-10).

At the phase of whole technical maturation of fruits of varieties the weight of fruit was 94,5 g in standard Dar Tashkenta variety and in Jaykhun F<sub>1</sub> standard hybrid was 108,5 g. In comparison with Dar Tashkenta variety Zumrad variety fruit mass was 138,2% heavy and in Zarya Vostoka, Tong and PP10676 varieties it was 74,3-89,1% lighter. The fruit weight of the remaining varieties constituted 95,2-100,2 g or 100,7-106,0% compared to standard variety. The group with 113,5-127,6% larger fruits compared to standard Jaykhun F<sub>1</sub> hybrid includes Adriatico F<sub>1</sub>, Figaro F<sub>1</sub> and Pkocraft F<sub>1</sub> hybrids. Average fruit mass in all the varieties was 93,9 g and in hybrids it made 115,3 g, the difference between them showed 122,8%.

Correlation coefficient relation between the number of fruits and weight of fruits of one plant in all varieties showed negative result ( $r=-0,71\pm 0,19$ ). Because, they are independent and there is no connection among them.

It was determined that the productivity of sweet pepper varieties which were grown in double cropping period was different over the years. In 2014 the productivity of standard Dar Tashkenta variety was 30,6 t/ha and less productivity of 82,0-86,9% was observed in Zarya Vostoka and Tong varieties than in standard. The highest yield among them was 34,1-37,6 t/ha or

compared to standard variety 111,4-122,9 % more yield was noted in Yulduz, Shodlik, D11200 and D08018 varieties.

The productivity of the remaining varieties was closer to the yield of standard variety. The second Jaykhun F<sub>1</sub> standard hybrid yield was equal to 36,7 t/ha, and the yield of Adriatico F<sub>1</sub> and Pkocraft F<sub>1</sub> hybrids was 114,2-115,0% higher than the standard. Figaro F<sub>1</sub> and Vedrana F<sub>1</sub> hybrids yield was 84,5-86,1% compared to standard hybrid.

In 2015 the productivity of Zarya Vostoka, Tong varieties was 85,0-85,3% less than in standard variety. Higher yield of 34,6-36,5 t/ha or 115,3-121,7% was observed in Yulduz, Shodlik, D11200, D08018 variety samples. The productivity of Zumrad, Sabo, PP10676 samples was equal with the productivity of standard variety. Jaykhun F<sub>1</sub> standard hybrid productivity was 35,3 t/ha and compared to it the productivity of Adriatico F<sub>1</sub> and Figaro F<sub>1</sub> hybrids was found to be 40,7-41,8 t/ha higher.

In 2016 standard Dar Tashkenta variety productivity constituted 32,1 tons per ha and compared to it 116,8-123,7% higher productivity was observed in Yulduz, Shodlik, D11200, D08018 varieties. The productivity of the remaining varieties (2,4 t/ha) didn't differ much from the standard one or was equal to it.

Standard Jaykhun F<sub>1</sub> hybrid productivity per ha made 40,3 tons and a bit higher productivity (46,1-44,3

t/ha) was noted in Adriatico F<sub>1</sub> and Pkocraft F<sub>1</sub> hybrids. It was identified that the productivity of other hybrids was 79,2-84,6% compared to standard hybrid.

Three year average productivity of standard Dar Tashkenta variety made 30,9 tons per ha, compared to it less (86,3-86,7%) yield indication was observed in Zarya Vostoka and Tong varieties (table-2).

The productivity indication (103,3-109,7%) close to standard version was observed in Zumrad, Sabo, PP10676 varieties. Compared to standard variety 113,7-119,3% more indication was noted in Yulduz variety and 123,0-126,3% more in Shodlik, D11200, D08018 varieties. The highest productivity (114,7-114,4%) was determined in F<sub>1</sub> Adriatico F<sub>1</sub> Pkocraft hybrids with 42,8-42,9 t/ha result than standard F<sub>1</sub> Jaykhun hybrid.

Biochemical content of fruits of sweet pepper samples was different. Dry matter of 8,75% existed in standard Dar Tashkenta variety and compared to it only in Sabo variety (9,88%) 112,9% more dry matter was found. Other remaining variety samples varied in this indication from 8,41 to 9,41% and was too close to the indication of standard variety.

Table 2

The productivity of varieties and hybrids of sweet pepper cultivated as double crop (in 2014-2016)

№	Varieties	productivity, t/ha			mean yield		
		2014	2015	2016	t/ha	compared to control, %	
						Dar Tashkenta	Jaykhun F <sub>1</sub>
1	Dar Tashkenta (st)	30,6	30,0	32,1	30,9	100,0	-
2	Zarya Vostoka	26,6	25,5	25,8	26,0	86,7	-
3	Zumrad	32,3	32,0	34,3	32,9	109,7	-
4	Tong	25,1	25,6	27,1	25,9	86,3	-
5	Sabo	31,5	30,5	30,8	31,0	103,3	-
6	Yulduz	34,1	35,8	37,5	35,8	119,3	-
7	Shodlik	36,5	34,6	39,7	36,9	123,0	-
8	PP 10676	32,1	32,4	34,3	32,9	109,7	-
9	D 11200	36,4	36,0	39,7	37,4	124,7	-
10	D 08018	37,6	36,5	39,5	37,9	126,3	-
11	Jaykhun F <sub>1</sub> (st)	36,7	35,2	40,3	37,4	-	100,0
12	Adriatico F <sub>1</sub>	41,9	40,7	46,1	42,9	-	114,7
13	Figaro F <sub>1</sub>	31,6	33,2	31,9	32,2	-	86,1
14	Vedrana F <sub>1</sub>	31,0	37,2	34,1	34,1	-	91,2
15	Dovras F <sub>1</sub>	35,2	33,8	34,1	34,4	-	92,0
16	Pkocraft F <sub>1</sub>	42,2	41,8	44,3	42,8	-	114,4
LSD <sub>05</sub>		0,26	0,25	0,30			
Sx, %		0,76	0,75	0,84			

## CONCLUSION

1. According to the results of the study the mass of stalk-leaf in one plant of standard variety made 275 g and in standard hybrid it was 296 g, compared to them

116,7% more indication was noted only in Zumrad variety. In other remaining samples indication was in the limit of experiment mistake. Interrelation of correlation coefficient between the root system weight

and stalk-leaf weight of one plant was strong ( $r=0,99\pm 0,04$ ).

2. The surface of leaves per plant in standard Dar Tashkenta variety and Jaykhun F<sub>1</sub> hybrid constituted 48 dm<sup>2</sup>, compared to them only in Zumrad variety and Adriatico F<sub>1</sub> hybrid this indication was 110,1-116,4% higher. In other varieties it was around 46-52 dm<sup>2</sup>, and showed 95,9-108,4% compared to standard.

3. At the phase of whole technical maturation of fruits of varieties the number of fruits of standard Dar Tashkenta plant variety is 6,8 pieces and in the second Jaykhun F<sub>1</sub> hybrid it was 7,1 pieces. Compared to the standard one 110,3-122,1% more fruits number was observed in Zarya Vostoka, Tong, Yulduz, Shodlik, PP10676, D11200 and D08018 varieties.

4. At the phase of whole technical maturation of fruits of varieties the weight of fruit was 138,2% heavier in Zumrad variety in comparison with standard Dar Tashkenta variety and compared to standard Jaykhun F<sub>1</sub> hybrid 113,5-127,6% larger fruits were observed in Adriatico F<sub>1</sub>, Figaro F<sub>1</sub> and Pkocraft F<sub>1</sub> hybrids. Average fruit mass in all the varieties was 93,9 g and in hybrids it made 115,3 g, the difference between them showed 122,8%.

5. At the phase of whole technical maturation of fruits correlation relation between the number of fruits of plants and weight of fruits was not noted during the analysis ( $r=-0,71\pm 0,19$ ). Finally it shows that the decrease in number of fruits results in the increase in fruit mass.

6. The productivity per ha made 30,9 tons in standard Dar Tashkenta variety and compared to it in Yulduz, Shodlik, D11200, D08018 varieties 113,7-126,3% higher indication was identified. The highest productivity constituted 42,8-42,9 t/ha in Adriatico F<sub>1</sub> and Pkocraft F<sub>1</sub> hybrids.

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