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## The yield of cucumber hybrids in double cultivation at different mineral nutrition and stand density

Toshtemir Ostonakulov<sup>1\*</sup>, Meiliyeva Khilola<sup>1</sup>

<sup>1</sup>Karshi State University, Karshi, Uzbekistan

\*E-mail: [t-ostonakulov@mail.ru](mailto:t-ostonakulov@mail.ru)

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### Abstract

The article presents the results of studying the growth, formation of the leaf surface area, the weight of the tops and roots, the productivity and yield indicators of the isolated hybrids of Fontina F1 and Record F1 cucumbers when cultivated in a repeated crop at different norms of organomineral fertilizers and standing density. Based on the results, it was found that the largest leaf area (58.0-62.8 thousand m<sup>2</sup>) in cucumber hybrids was noted with the scheme (180 + 60): 2x40 cm with a density of 35.7 thousand plants per 1 ha and joint fertilization normally 20 t/ha of manure + N<sub>200</sub> P<sub>160</sub> K<sub>100</sub> kg/ha. At the same time, the leaf surface area from a bush was 1546-1624 dm<sup>2</sup>, the weight of the tops was 1408-1517 g, the weight of the roots in the arable layer was 98.1-106.2 g, the yield of the bush was 7.9-8.5 kg, the average weight of one fruit per bush 180.6-196.0 g. However, due to the increase in the density of bushes, the highest yield (204.1-219.6 centners/ha) was obtained in both hybrids of cucumbers, that is, the increase was 21.6 per hectare-26.2 centners or 113.5-118.5%.

**Key words:** cucumbers; hybrid; standing density; fertilizer rates; leaf surface area; yield

## INTRODUCTION

In the republic of Uzbekistan, cucumbers (*Cucumis sativus* L) are a popular, widespread vegetable crop. Its unripe fruits are consumed fresh, salted, canned. Their nutritional value is determined mainly by their high palatability as a seasoning that promotes better absorption of food. The fruits in removable ripeness contain 95.0-96.0% water, nitrogenous substances - 0.86, sugars - 1.5-2.5%, protein - 0.8-1.0%, fiber - 0.4 -0.8%. In addition, cucumber fruits contain vitamins A1, B1, B2, PP and C, there are a lot of potassium, calcium and phosphorus salts in the ash, which is second only to radish in the amount of alkaline salts that improve the functioning of the heart and kidneys. The essential oils contained in cucumber fruits stimulate the appetite. Cucumbers are widely used in medicine and pharmaceuticals. In people with diabetes mellitus, an in-

dispensable food product is in the diet (Balashev & Zeman, 1980; Ostonakulov et al., 2019; Christioglo, 2000).

A number of scientists have studied the effect on the formation of a bush, the amount of yield and the biochemical composition of cucumber fruits when grown at different times and methods of sowing (Sen et al., 2023; Yilmaz & Gebologlu, 2000; Singh et al., 2020).

In our country, cucumbers are cultivated annually on an area of 18-20 thousand hectares, and the yield per hectare is 14000-15000 kg. According to the average annual rate of consumption of cucumber during the year should be 10-13 kg. Currently, the need is met by 60-70%. Therefore, an important reserve for increasing the production of cucumbers in the republic is the expansion of the area in recrop after winter cereals (Ostonakulov et al., 2017).

In the conditions of irrigated light gray soils of the Kashkadarya region, obtaining high and guaranteed yields of cucumber in a repeated crop largely depends on the correct selection of hybrids of this crop, as well as ensuring sufficient mineral nutrition and standing density. However, this issue has not been studied in these regions.

The purpose of the research is comparative study of two cucumber hybrids under the conditions of double cultivation at different mineral nutrition and stand density of the Kashkadarya region.

## MATERIALS AND METHODS

Field experiments were carried out in the household plot of Khaydarov Yusuf, Khalkabad mahalla, Guzar district. The arable horizon is characterized by a humus content of 1.09%, in a solution of water extract - pH = 7.1, soil bulk density - 1.27-1.30 g/cm<sup>3</sup>, specific gravity - 2.4-2.5 g/cm<sup>3</sup>, gross nitrogen - 0.12%, gross phosphorus - 0.23%, gross potassium - 2.04%, nitrate nitrogen - 4.52 mg/kg, ammonium nitrogen - 1.85 mg/kg, mobile phosphorus - 16, 72 mg/kg, exchangeable potassium - 195 mg/kg.

In the experiment, heterosis cucumber hybrids Fontina F1 and Record F1 were studied in 3 organomineral backgrounds - 20 t/ha of manure + N<sub>100</sub>P<sub>80</sub>K<sub>50</sub> kg/ha; 20 t/ha manure + N<sub>150</sub>P<sub>120</sub>K<sub>75</sub> kg/ha and 20 t/ha manure + N<sub>200</sub>P<sub>160</sub>K<sub>100</sub> kg/ha. In each organomineral background, 4 seeding schemes were compared - (180 + 60):2x40 cm with a density of 35.7 thousand plants per hectare; (180+60):2x50 cm, 28.6; (270 + 90):2x40 cm, 27.8 (270 + 90):2x50 cm, 22.2 thousand plants per hectare.

Sowing was carried out on July 10-12 at a depth of 4-5 cm by hand. Before and after sowing, they watered and maintained soil moisture at 70-80% of the PSMC until germination.

The plot area for fertilizer is 144-216 m<sup>2</sup>, according to the sowing scheme 72-108 m<sup>2</sup>, for varieties 36-54 m<sup>2</sup>, 4-fold repetition. After the emergence of seedlings on the 8-10th day, the first time, and after the appearance of 4-5 true leaves, thinning was carried out and the second time a complex treatment - hoeing and cultivation. The annual rate of manure and potassium chloride, 75% of ammophos were applied under the main treatment, the rest (25%) of the rates of ammophos before sowing, nitrogen fer-

tilizers were applied during the growing season in two top dressings.

On the experimental plots, all records, observations, analyzes and calculations were carried out according to the generally accepted methodology and agro-recommendations (Azimov & Azimov, 2002; Belik, 1992; State Register, 2022; Litvinov, 2011).

The yield data were statistically processed according to B. A. Dospekhov by the method of dispersion analysis, the accuracy of the experiment and LSD<sub>0.5</sub> were established (Dospekhov, 1985).

## RESULTS AND DISCUSSION

In the republic, the issues of the sowing scheme and plant density of various varieties of cucumbers in the main crop were studied by N. N. Balashev, V. I. Zuev, S. M. Mezhidov, etc. However, in repeated culture after grain crops, various heterotic hybrids on different backgrounds of fertilizers remain unexplored.

According to the results of the study, it was revealed that the growth, development and productivity of the studied hybrids of cucumbers at different norms of organomineral fertilizers and standing density at the beginning of technical maturity differ significantly (Table 1).

When cultivating hybrids of Record F1 cucumbers in the variant of 20 t/ha of manure + N<sub>100</sub>P<sub>80</sub>K<sub>50</sub> kg/ha and a density of 35.7 thousand per hectare, the growing season was - 54 days. With a density of 28.6 thousand per hectare - 56 days, with a density of 27.8 thousand plants per hectare - 57 days, and with a density of 22.2 thousand per hectare the growing season was - 59 days. With an increase in fertilizer rates, especially organomineral fertilizers, the growing season lengthens to 61-63 days. The studied cucumber hybrid Fontina F1 had a vegetative period of 51-62 days according to the variants of the experiment. Thus, with the joint application of 20 t/ha of manure + N<sub>200</sub>P<sub>160</sub>K<sub>100</sub> kg/ha, the vegetation period was extended by 3-6 days, and the increase in standing density decreased by 2-3 days.

The studied hybrids of cucumbers differed markedly in length and number of the main stem, the longest (188-196 cm) and multi-stemmed (3.9-4.3 pieces) in both hybrids were noted when fertilizing at a rate of 20 t/ha of manure + N<sub>200</sub>P<sub>160</sub>K<sub>100</sub> kg / ha and the scheme (270+90):2x50 cm with a density of 22.2

**Table 1.** Growth, development and productivity of selected hybrids of cucumbers in repeated culture (2021-2022, 10-12.07, planting depth 4-5 cm)

№	Experience Options		Vegetation period, in days	Main stem length, cm	Number of main stems	Leaf area, dm <sup>2</sup>	From one bush			Average weight of one fruit, g/шт, r
	sowing scheme, cm	sowing scheme, cm					weight of tops, g	weight of roots, g	Yield per bush, g	
20 t/ha manure + N <sub>100</sub> P <sub>80</sub> K <sub>50</sub> kg/ha hybrid Record F <sub>1</sub>										
1.	<b>(180+60):2x40</b>	35,7	54	163	3,2	1443	1268	89,6	6,2	159,4
2.	<b>(180+60):2x50</b>	28,6	56	169	3,4	1617	1301	96,3	6,7	167,7
3.	<b>(270+90):2x40</b>	27,8	57	168	3,3	1563	1293	94,0	6,5	165,3
4.	<b>(270+90):2x50</b>	22,2	59	174	3,6	1724	1322	101,2	6,9	171,5
			<b>LSD<sub>05</sub>=</b>	<b>2-4</b>			<b>11-15</b>	<b>8-14</b>	<b>1,6-4,2</b>	
20 t/ha manure + N <sub>150</sub> P <sub>120</sub> K <sub>75</sub> kg/ha hybrid Record F <sub>1</sub>										
5.	<b>(180+60):2x40</b>	35,7	55	175	3,5	1565	1485	95,3	6,5	171,2
6.	<b>(180+60):2x50</b>	28,6	57	186	3,8	1727	1512	102,1	7,0	178,0
7.	<b>(270+90):2x40</b>	27,8	58	181	3,7	1642	1496	98,6	6,8	176,6
8.	<b>(270+90):2x50</b>	22,2	61	190	4,0	1785	1540	108,6	7,4	184,2
			<b>LSD<sub>05</sub>=</b>	<b>4-6</b>			<b>13-19</b>	<b>12-23</b>	<b>1,9-5,1</b>	
20 t/ha manure + N <sub>200</sub> P <sub>160</sub> K <sub>100</sub> kg/ha hybrid Record F <sub>1</sub>										
9.	<b>(180+60):2x40</b>	35,7	57	187	3,7	1624	1517	106,2	7,4	186
10.	<b>(180+60):2x50</b>	28,6	59	193	4,0	1762	1592	111,0	7,7	192
11.	<b>(270+90):2x40</b>	27,8	60	191	4,0	1708	1564	108,1	8,0	189
12.	<b>(270+90):2x50</b>	22,2	63	196	4,3	1835	1619	120,5	8,5	196
			<b>LSD<sub>05</sub>=</b>	<b>1-3</b>			<b>18-31</b>	<b>21-28</b>	<b>2,2- 3,4</b>	
20 t/ha manure + N <sub>100</sub> P <sub>80</sub> K <sub>50</sub> kg/ha hybrid Fontina F <sub>1</sub>										
13.	<b>(180+60):2x40</b>	35,7	51	152	2,8	1326	1166	82,1	5,6	147,2
14.	<b>(180+60):2x50</b>	28,6	53	164	3,1	1478	1204	85,4	6,1	155,1
15.	<b>(270+90):2x40</b>	27,8	54	161	3,0	1456	1183	83,7	6,0	152,0
16.	<b>(270+90):2x50</b>	22,2	56	170	3,3	1609	1225	88,1	6,4	159,8
			<b>LSD<sub>05</sub>=</b>	<b>4-7</b>			<b>15-27</b>	<b>9-13</b>	<b>2-3</b>	
20 t/ha manure + N <sub>150</sub> P <sub>120</sub> K <sub>75</sub> kg/ha hybrid Fontina F <sub>1</sub>										
17.	<b>(180+60):2x40</b>	35,7	53	168	3,2	1452	1298	89,2	5,9	163,0
18.	<b>(180+60):2x50</b>	28,6	56	176	3,4	1596	1345	94,0	6,5	170,2
19.	<b>(270+90):2x40</b>	27,8	58	172	3,2	1538	1336	90,2	6,3	168,5
20.	<b>(270+90):2x50</b>	22,2	61	181	3,5	1612	1392	101,5	6,8	176,2
			<b>LSD<sub>05</sub>=</b>	<b>3-6</b>			<b>9-17</b>	<b>15-22</b>	<b>2-5</b>	
20 t/ha manure + N <sub>200</sub> P <sub>160</sub> K <sub>100</sub> kg/ha hybrid Fontina F <sub>1</sub>										
21.	<b>(180+60):2x40</b>	35,7	55	173	3,4	1546	1408	98,1	6,9	171,4
22.	<b>(180+60):2x50</b>	28,6	57	184	3,7	1685	1446	105,3	7,2	176,5
23.	<b>(270+90):2x40</b>	27,8	60	177	3,5	1634	1435	102,6	7,6	174,2
24.	<b>(270+90):2x50</b>	22,2	60	188	3,9	1759	1489	114,2	7,9	180,6
			<b>LSD<sub>05</sub>=</b>	<b>2-3</b>			<b>13-18</b>	<b>17-24</b>	<b>6-9</b>	

**Table 2.** Productivity of selected hybrids of cucumbers in repeated culture

№	Experience options		Yield by years, centner/ha		Average yield, centner/ha	Increase compared to control	
	sowing scheme, cm	standing density, thous. per 1 ha	2021	2022		c/ha	%
20 t/ha manure + N <sub>100</sub> P <sub>80</sub> K <sub>50</sub> kg/ha hybrid Record F <sub>1</sub>							
1.	<b>(180+60):2x40</b>	35,7	190,8	196,0	193,4	-	100,0
2.	<b>(180+60):2x50</b>	28,6	190,0	192,4	191,2	-	100,0
3.	<b>(270+90):2x40</b>	27,8	184,7	172,5	178,6	-	100,0
4.	<b>(270+90):2x50</b>	22,2	180,0	166,4	173,3	-	100,0
		<b>LSD<sub>05</sub>=</b>	<b>7,7</b>	<b>5,0</b>			
20 t/ha manure + N <sub>150</sub> P <sub>120</sub> K <sub>75</sub> kg/ha hybrid Record F <sub>1</sub>							
5.	<b>(180+60):2x40</b>	35,7	207,4	196,2	201,8	8,4	104,4
6.	<b>(180+60):2x50</b>	28,6	200,7	190,4	195,5	4,3	102,2
7.	<b>(270+90):2x40</b>	27,8	192,1	180,3	186,2	7,6	104,3
8.	<b>(270+90):2x50</b>	22,2	185,4	172,6	179,0	5,8	103,3
		<b>LSD<sub>05</sub>=</b>	<b>6,4</b>	<b>4,5</b>			
20 t/ha manure + N <sub>200</sub> P <sub>160</sub> K <sub>100</sub> kg/ha hybrid Record F <sub>1</sub>							
9.	<b>(180+60):2x40</b>	35,7	224,1	215,1	219,6	26,2	113,5
10.	<b>(180+60):2x50</b>	28,6	215,9	204,3	210,1	18,9	109,9
11.	<b>(270+90):2x40</b>	27,8	206,2	192,4	199,3	20,7	111,6
12.	<b>(270+90):2x50</b>	22,2	200,0	183,6	191,8	18,6	110,7
		<b>LSD<sub>05</sub>=</b>	<b>9,6</b>	<b>6,3</b>			
20 t/ha manure + N <sub>100</sub> P <sub>80</sub> K <sub>50</sub> kg/ha hybrid Fontina F <sub>1</sub>							
13.	<b>(180+60):2x40</b>	35,7	181,7	163,3	172,5	-	100,0
14.	<b>(180+60):2x50</b>	28,6	178,2	160,2	169,5	-	100,0
15.	<b>(270+90):2x40</b>	27,8	176,8	160,0	168,4	-	100,0
16.	<b>(270+90):2x50</b>	22,2	169,3	156,1	162,7	-	100,0
		<b>LSD<sub>05</sub>=</b>	<b>7,3</b>	<b>5,4</b>			
20 t/ha manure + N <sub>150</sub> P <sub>120</sub> K <sub>75</sub> kg/ha hybrid Fontina F <sub>1</sub>							
17.	<b>(180+60):2x40</b>	35,7	186,7	178,9	182,8	10,3	106,0
18.	<b>(180+60):2x50</b>	28,6	180,8	175,4	178,1	8,6	105,1
19.	<b>(270+90):2x40</b>	27,8	184,7	168,7	176,7	8,3	105,0
20.	<b>(270+90):2x50</b>	22,2	178,4	162,4	170,4	6,1	104,7
		<b>LSD<sub>05</sub>=</b>	<b>6,3</b>	<b>4,6</b>			
20 t/ha manure + N <sub>200</sub> P <sub>160</sub> K <sub>100</sub> kg/ha hybrid Fontina F <sub>1</sub>							
21.	<b>(180+60):2x40</b>	35,7	206,9	201,3	204,1	21,6	118,5
22.	<b>(180+60):2x50</b>	28,6	198,2	182,6	190,4	20,9	112,3
23.	<b>(270+90):2x40</b>	27,8	192,3	175,3	183,8	15,4	109,1
24.	<b>(270+90):2x50</b>	22,2	181,9	168,7	175,3	12,6	107,7
		<b>LSD<sub>05</sub>=</b>	<b>7,6</b>	<b>5,2</b>			



thousand plants per 1 ha. When sowing according to the scheme (180+60):2x50 cm, these figures were 184-193 cm, 3.7-4.0 pcs.

The leaf surface area from 1 bush of cucumbers by hybrids, sowing patterns, planting density and the rate of mineral fertilizers changed significantly and, according to the experimental options, ranged from 1326 to 1835 dm<sup>2</sup>, the highest leaf surface area in both studied hybrids of cucumbers from 1 bush (1759-1835 dm<sup>2</sup>) were observed with the joint ap-

plication of fertilizers at a rate of 20 t/ha of manure + N<sub>200</sub>P<sub>160</sub>K<sub>100</sub> kg/ha, sowing pattern (270+90):2x50 cm with a density of 22.2 thousand plants per 1 ha. At the same time, the leaf surface area was 39.1-40.7 thousand m<sup>2</sup>. The largest leaf surface area (58.0-62.8 thousand m<sup>2</sup>) in hybrids of Fontina F1 and Record F1 cucumbers was noted with the scheme (180 + 60):2x40 cm with a density of 35.7 thousand plants per 1 ha and joint fertilization normally 20 t/ha of manure + N<sub>200</sub>P<sub>160</sub>K<sub>100</sub> kg/ha. At the same time, the



**Picture 1.** Fruits of the hybrid Record F1 at harvest



**Picture 2.** Fruits of the hybrid Fontina F1 at harvest

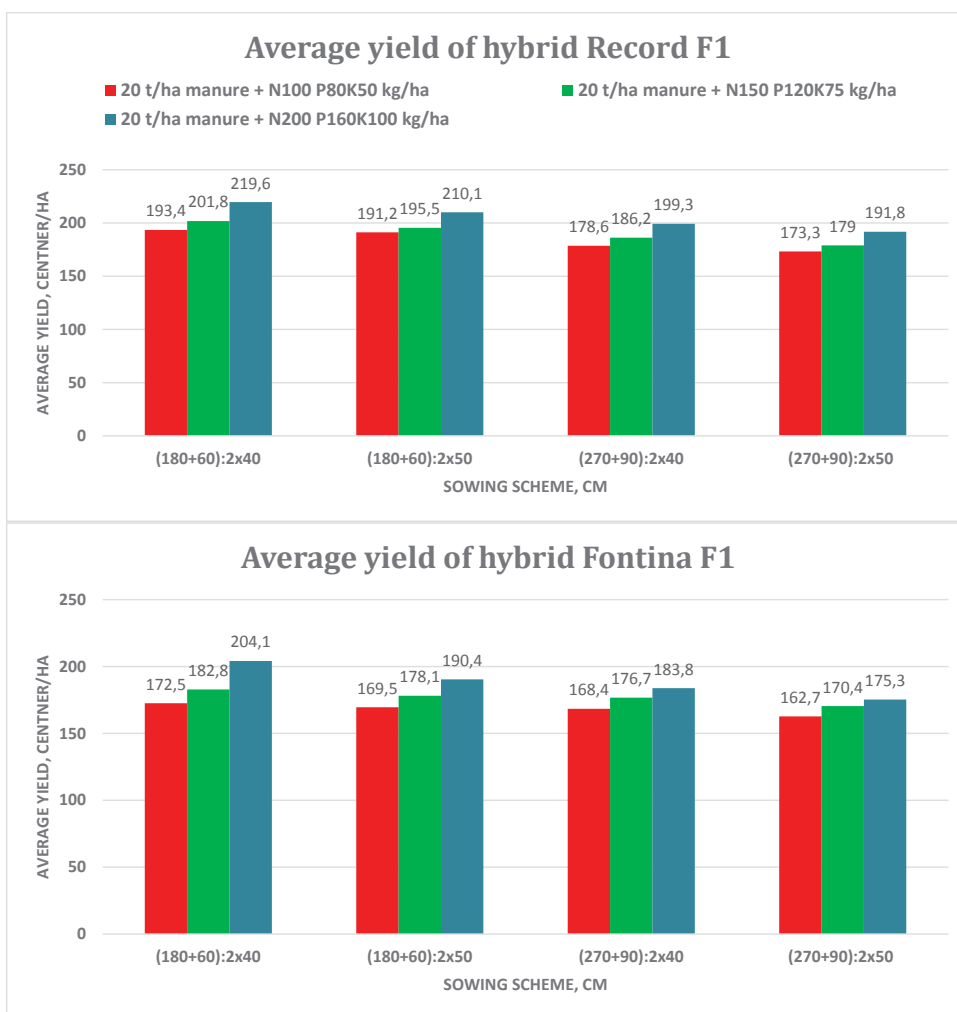


Figure 1. Average yield, centner/ha

leaf surface area from the bush was 1546-1624 dm<sup>2</sup>, the weight of the tops was 1408-1517 g, the weight of the roots was 98.1-106.2 g, the yield of the bush was 7.9-8.5 kg, the average weight of one fruit in the bush was 180, 6-196.0

However, due to the increase in standing density from 22.2 to 35.7 thousand plants per 1 ha, the productivity indicators of the studied variants are lower, and due to the increase in standing density bushes, the highest yield was obtained in both hybrids of cucumbers 204.1-219.6 t/ha (Table 2). At the same time, the yield increase was 21.6-26.2 centners per hectare, or 113.5-118.5% compared with the control. The lowest yield of both cucumber hybrids (162.7-173.3 c/ha) was observed when organic fertilizers were applied at a rate of 20 t/ha

of manure + N<sub>100</sub>P<sub>80</sub>K<sub>50</sub> kg/ha with a density of 22.2 thousand plants per 1 ha according to the scheme (270+90):2x50 cm.

## CONCLUSIONS

Under the conditions of irrigated light gray soils of the Kashkadarya region by cultivating heterosis cucumber hybrids Fontina F1 and Record F1 in a double cultivation with a sowing scheme (180 + 60): 2x40 cm with a density of 35.7 thousand plants per hectare and joint fertilization at a rate of 20 t/ha of manure + N<sub>200</sub>P<sub>160</sub>K<sub>100</sub> kg/ha, you can get an annual yield per hectare of 200-220 centners. This will enable farmers to conserve resources and improve crop production.

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