The influence of planting period on productivity of hot pepper varieties

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Abstract: This article deals with varieties of hot pepper suitable for cultivation in protected ground, the length of fruits in the ripening period and the thickness of fruit pulp, the number of fruits on the bush in the period of technical ripeness of fruits, the weight of fruits. one fruit, the total weight of fruits on the bush, and about the same amount per square metre. The obtained yield indices are given. The aim of the study is to determine the optimal planting scheme of newly developed varieties of hot pepper. New varieties of hot pepper "Sharq Gavhari", "Dilnoz 2019" and "Niyat", suitable for cultivation in greenhouses, showed the highest and lowest yields when planted in unheated greenhouses in Tashkent district of Tashkent region in early spring in 4 terms: 10 and 20 February, 1 and 10 March. High quality yields were recorded for all varieties planted on 10 March and were 9.1 kg/m^2 for the variety "Sharq Gavhari", 7.7 kg/m^2 for the variety "Dilnoz 2019", and for the variety "Niyat" – 8.4 kg/m^2.

1 Introduction

Today there are 4.4 million hot peppers (Capsicum annuum L.) in the world 68.3 mln. tons of products are being produced. The average yield is 100-110 tons per hectare in greenhouses, and 14.1-18.3 tons in open fields. Nowadays, interest and demand for hot pepper crop is increasing day by day, this crop is grown in all countries of the world. The global average yield of hot pepper (Capsicum annuum L.) "Increased from 7.3 tons in 2006 to 18.4 tons in 2019 in open fields, while it increased from 80 tons to 110 tons in greenhouses" creation of varieties of hot pepper resistant to heat and cold, suitable for growing in salty soils, and resistant to diseases and pests is one of the urgent issues [1-8].

In recent years, in the world, scientific researches have been carried out to create hot pepper varieties suitable for growing in unheated greenhouses, with a level of bitterness above 10 points, exportable, good fruit quality, with a yield of 80-90 t/ha using innovative methods, and to determine optimal planting periods and schemes in unheated greenhouse conditions. is going Hot pepper is the main crop in the leading countries in the cultivation of hot pepper, and it is also widely used in the industrial and pharmaceutical fields. Therefore, creating high-yielding varieties suitable for cultivation in unheated greenhouse conditions is an important scientific direction. Selection of its varieties suitable for cultivation in unheated

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greenhouse conditions, development of important elements of cultivation technology, and provision of new barra products to the population throughout the year is one of the urgent tasks of today.

There is a lot of information in foreign literature on the cultivation of hot pepper in heated and unheated greenhouses.

To date, about 2,000 varieties and hybrids of hot pepper have been created in the world, and hot pepper is a crop that stands out among vegetable crops with its unique taste. The presence of alkaloid capsaicin in its composition, which determines its bitterness, gave information about the reason for the wide use of this plant in medicine and in the manufacturing industry [2].

In the research conducted on the study of hot pepper species, it was reported that some species of "Capsicum L" have similar morphological characteristics, it is difficult to distinguish them during the vegetative period, especially that there is no significant morphological change in the shape, color and size of the fruit [1].

In order to obtain a high and quality yield from the assiq pepper crop, there are optimal dates for planting seedlings at different times of the year in different countries. Among the countries where hot pepper is most widely planted in the world, hot pepper seeds are planted in China from January to May depending on the growing season, in India from August 30 to December 15, and in Indonesia, seedlings are planted in two seasons [8].

2 The level of study of the problem

P.Bosland, K.Masushma, SH.Tong, S.Zusetsu, D.Zhang, G.Doshi in foreign countries on issues of development and improvement of hot pepper (Capsicum annuum L.) cultivation technologies in open and protected areas in different regions S.Dlishen, V.Talakh, V.A.Ludilov, O.N.Pyshnaya, T.Aytbaev, in Uzbekistan V.I.Zuev, L.G. Kalyagina, E.V.Ermolova, A. M.Abbasov,

Research works were carried out by such scientists as M.Karabaev, R.F. Mavlyanova, B.B. Azimov.

The authors have created the principles of choosing a variety for growing hot pepper in open fields, determining the optimal age of seedlings according to the planting period, and conducting scientific research on this vegetable crop. Recommendations for optimal planting periods, planting schemes, watering and fertilizing norms for growing hot pepper in open ground and in greenhouses are given.

However, research and development work on the cultivation of hot pepper in unheated film greenhouses has not been carried out sufficiently in our republic. Based on this, selection of hot pepper varieties, development and implementation of planting periods and schemes in an unheated greenhouse remain an urgent task. Solving these tasks will solve a number of problematic issues that arise in the country during off-season periods in the high demand for export of this vegetable and in providing the population with fresh hot pepper products.

The aim of the research is to create varieties of hot pepper (Capsicum annuum L.) with high yield and good fruit quality suitable for growing in greenhouses.

3 Research methods

Greenhouse and laboratory research, "Method of conducting experiments on vegetable, potato and potato crops", "Metodicheskie ukazaniya po izucheniyu i podderjaniyu mirovoy kollektsii ovoshchnyx paslenovykh kultur (tomaty, pertsy, eggplant)", "Metodicheskie rekomendatsii po proveveniyu opytov s ovoshchnymi kul'turami v soorujeniyax

zashchishchen grunta (NIIOX)", and the statistical analysis of the results was carried out using the Microsoft Excel program in the dispersion analysis method of B.A.Dospehov.

Research results indicate that one of the important factors determining the productivity of vegetable crops in unheated film greenhouses is the optimal planting period. It is very important to determine the optimal planting time of seedlings in the set of agrotechnical activities aimed at obtaining high and quality harvest. Seedlings are planted in different periods depending on the biological characteristics of vegetable crops, first of all, temperature requirements and duration of the growing season, soil, climate, and weather conditions, as well as the production plan and the purpose for which the product is grown. In addition, in order to extend the period of consumption of the product, seedlings are planted at different times.

Weather and soil climate conditions of our republic are changing from year to year. This requires our scientists to create new vegetable crops suitable for the climatic conditions of our country, and to study the optimal planting periods of the created crops in open and protected areas, to get a higher yield and to satisfy the population's need for vegetable crops throughout the year.

Hot peppers are grown in household plots along with vegetable crops. But there is not enough scientifically based information on its early spring planting dates in unheated film greenhouses. The main goal of our research is to determine the optimal planting period for obtaining a high and high-quality yield of hot pepper in unheated film greenhouses during the off-season. It is very important to correctly determine the planting dates of vegetable crops in protected lands. If the planting dates are delayed by one week, the yield will decrease by 20-25% and the next harvest will be delayed by 7-10 days.

Table-1. Indicators of fruit length, diameter and flesh thickness of hot pepper cultivars planted in different periods under unheated greenhouse conditions

Planting deadlines	During the period of fruit ripening of plants					
	fruits length		fruits diameter		fruit flesh thickness	
	cm	with respect to control,%	cm	with respect to control,%	mm	with respect to control,%
«Sharq gavhari»						
10 February	13,7	113,2	2,0	67,0	1,4	70,0
20 February	13,4	111,0	2,4	80,0	1,5	75,0
1 March (control)	12,1	100,0	3,0	100,0	2,0	100,0
10 March	12,3	102,0	3,3	110,0	2,4	120,0
×	12,9	106,6	2,7	89,3	1,8	91,3
	r=0,84±0,16					
«Dilnoz 2019»						
10 February	23,4	116,0	2,2	66,7	1,0	50,0
20 February	22,7	112,3	2,4	73,0	1,4	70,0

1 March (control)	20,2	100,0	3,3	100,0	2,0	100,0
10 March	19,3	95,5	3,5	106,1	2,3	115,0
×	21,4	106,0	2,9	86,5	1,7	83,8
	r=0,82±0,18					
«Niyat»						
10 February	20,2	112,0	2,1	68,0	1,1	55,0
20 February	19,4	107,1	2,4	77,4	1,4	70,0
1 March (control)	18,1	100,0	3,1	100,0	2,0	100,0
10 March	17,1	94,4	3,4	110,0	2,4	120,0
×	18,7	103,4	2,8	88,9	2,0	86,3
	r=0,86±0,14					

Different planting dates had an effect on the shape of hot pepper fruits. From the data presented in the table, it can be seen that as the planting period increased by 10-20 days, the length of the fruit was slightly longer compared to the control option, and the diameter of the fruit was slightly smaller compared to the control option. During the ripening period, the length of the fruit of the "Sharq Gavhari" variety was 12.1 centimeters in the control variant, while in the first and second variants this indicator was 13.7–13.4 cm or 1.6–1.3 centimeters longer than the control variant. The fourth option, which was ten days later than the control, did not differ significantly from the control at planting time, 12.3 cm or 2.0% longer than the control. Fruit diameter and flesh thickness were shorter in plants planted 10-20 days before the control variant of the variety "Sharq Ghavhari", and 10-20% higher in the variant planted 10 days after the control.

During fruit ripening, the length of the fruit was 20.2 centimeters in the control variant of the "Dilnoz 2019" variety, while in the first and second variants this indicator was 23.4–22.7 cm or 3.4–2.5 centimeters longer than the control. In the version that was ten days later than the control, it was 19.3 cm or 0.9 cm smaller than the control. Fruit diameter was also 2.2–2.4 cm or 6.7–7.3% smaller than the control in the variants 10–20 days earlier than the control. When the pulp thickness was determined, the fruits of the plants planted in the fourth option, planted 10 days after the control, were 3.5 cm thick or 6.1% thicker than the control. In the "Niyat" variety, the length of the fruit per plant during fruit ripening was 18.1 centimeters in the control option, 20.2 centimeters in the first option, or 12.0% longer than the control, and 19.4 centimeters or 7.1 in the second option. and in the fourth variant, which is ten days later than the control, the planting period is long

It was 17.1 cm or 5.6% smaller than the control. Fruit diameter was 3.1 cm in the control variant, but 2.1–2.4 cm or 22.6–32% smaller in the variants 10–20 days before the control. The fourth option, planted 10 days after the control, was 3.4 cm or 10 percent thicker than the control.

The thickness of the pulp showed thinning in the variants before the control. In the control variant, the thickness of the flesh of the fruit was 2 mm, while in the first and second variants it was 1.1–1.4 mm or 30–45% thinner than the control. In the fourth variant, it was 2.4 mm or 20% thicker than the control. The thickness or thinness of the flesh of the fruits determines the planting time depending on the purpose of the product. Correlation relationship between fruit length and fruit diameter during fruit ripening was strong in "Sharq gavhari" variety r=0.84±0.16. This regularity was stronger in "Dilnoz 2019" and "Niyat" varieties planted in

the experiment, r=0.82±0.18, r=0.86±0.14. Table 2 shows the number of fruits per bush and the weight of marketable fruits of hot pepper varieties planted in different periods.

It is known that the period of planting vegetable crops does not leave its influence on its productivity, therefore it is necessary to know how to correctly choose the period of planting in order to obtain a high and high-quality harvest. During the technical ripening period of the fruits, the number of fruits per bush in the control option of the variety "Sharq Ghavhari" was 125, it was 112 or 10.4% less than the control planted in the first option, and there was no significant difference from the control when planted in the second and fourth options, 116-128 or 0.2–7.2% more than the control. Fruit weight was 19 g in the control variant, 14.3–15.4 g in the first and second variants, or 18.9–24.7% lighter than the control. Total fruit weight was 2.3 kg in the control option, 1.6 kg or 30.4% lighter than the control in plants planted in the first option and 1.7 kg or 26.1% lighter than the control when planted in the second option. The fourth variant was found to be 2.6 kg or 13% heavier than the control.

Productivity indicators were 5.6 kg/m2 in the control option, 5.9 kg/m2 when planted in the first and second options, or 26.8-30% less than the control. In the variant with a 10-day delay in planting, the yield was 9.1 kg/m2 or 3.2 kg/m2 more than the control, the LSD05 index was 2.2, and the accuracy of the experiment was S=2.7%.

Table 2. Marketable fruit weight and number of fruits per bush of hot pepper cultivars planted at different periods under unheated greenhouse conditions

Planting deadlines	In the period of technical ripening of fruits in one plant							
	fruits the number		weight of one piece of fruit		total fruit weight		productivity	
	piece	%	g	%	kg	%	kg/m^2	%
«Sharq gavhari»								
10.February	112,0	89,6	14,3	75,3	1,6	69,6	5,6	70
20 February	116,0	92,8	15,4	81,1	1,7	73,9	5,9	73,8
1 March (control)	125,0	100,0	19,0	100,0	2,3	100,0	8,0	100
10 March	128,0	102,4	20,3	106,8	2,6	113,0	9,1	113,8
×	120,3	96,2	16,9	88,3	2,0	85,9	7,2	89,4
LSD_{05} kg/m^2							2,2	
Sx,%							2,7	
	r=0,99±0,11							
«Dilnoz 2019»								
10.February	91,0	93,8	17,2	84,3	1,5	78,9	5,2	78,8
20.February	93,0	95,9	18,3	89,7	1,7	89,5	5,9	89,4
1March (control)	97,0	100	20,4	100,0	1,9	100,0	6,6	100,0
10 March	107,0	110,3	21,2	103,9	2,2	115,8	7,7	116,7
×	97,0	100	19,3	94,5	1,8	96,1	6,4	96,2
LSD_{05} kg/m^2							1,7	
Sx,%							2,1	
	r=0,92±0,12							
«Niyat»								
10.February	89,0	95,7	18,3	75,9	1,6	72,7	5,6	72,7

20 February	91,0	97,8	20,4	84,6	1,8	81,8	6,3	81,8
1 March (control)	93,0	100,0	24,1	100,0	2,2	100,0	7,7	100,0
10 March	95,0	102,2	25,3	105	2,4	109,1	8,4	109,1
×	92,0	98,9	22,0	91,4	2,0	90,9	7,0	90,9
LSD_{05} kg/m^2							1,8	
Sx,%							2,6	
	r=0,98±0,09							

In the "Dilnoz 2019" variety, the number of fruits per bush was 97.0 pieces in the control option, while it was 91-93 pieces or 4.1-6.2% less than the control in the plants planted in the first and second option. 107.0 pieces in the plants planted in the fourth option. or 10.3 percent more than the control. The weight of one fruit was 20.4 g in option, 17.2–18.3 g in the first and second option or 10.3–15.7% less than the control, and 21.2 pieces in the option with a delay of 10 days or 3 from the control increased by 9 percent. The total weight of fruits per bush was 1.9 kg in the control option, while it was 1.5–1.7 kg or 10.5–20.1% less in plants planted in the first and second option, or 10.5–20.1% less than the control. In plants planted in the fourth option, 2.2 kg or 15.8% more than the control. This regularity was also observed in the number of fruits, weight of one fruit, weight of total fruits and productivity per square meter of the "Niyat" variety. In the period of technical ripening of fruits, the correlation between the number of fruits on one plant and the weight of total fruits was strong in "Sharq gavhari" variety r=0.99±0.11. This regularity was strong in "Dilnoz 2019" and "Niyat" cultivars planted in the experiment, r=0.92±0.12, r=0.98±0.09.

References

1. Aguilar-Melendez A., Morrell P.L., Roose M.L., Kim S.C., American Journal of Botany **96(6):** 1190–1202 (2009)
2. In Partial Fulfillment of the Requirements for the Degree of Master of Science in Horticulture (Vegetable Science) By Seleshi Delelegn March, 2011 Jimma University P. 92–97 (2011)
3. Nadeem M., Muhammad F., Anjum S., Khan A., Saed M., Riaz A., Pakistan Journal of Food Science **21(14),** 45–51 (2011)
4. Baral J., Bosland P., Journal of American Society of Horticultural Science, pp. 316–324 (2012)
5. Gikalo G.S. Rayonised varieties of hot pepper./Cultivation of pepper and aubergine in Krasnodar Krai. (Kn. Izdvo, 1982)
6. Gavrish S.F., Sysina E.A., Alichevskaya E.V., Shmorgunov G.T. // Potato and Vegetables **6,** 45-46 (1988)
7. B.B. Azimov, R.F. Mavlianova, B.J. Azimov, Tips for growing a good harvest of hot peppers (Toshkent 2016)
8. V.A. Ludilov, M.I. Ludilova, Scientific Proceedings of Biryuchekutskaya vegetable breeding experimental station. in. **2,** 111-119 (1972)