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Influence of different norms of fertilizers and application of growth stimulant on growth, development and productivity of sweet pepper variety in the conditions of Kashkadarya region

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Abstract
The article presents the results of a study of growth, development, leaf surface area, the formation of a mass of tops and roots, the total and marketable yields of the Dar Tashkent sweet pepper variety at various norms of organomineral fertilizers with the use of growth stimulant, in particular gibberellin.

It was revealed that with the joint application of organomineral fertilizers at a rate of 20 t/ha + $N_{200}P_{160}K_{100}$ kg/ha and the treatment of plants during the flowering period with gibberellin solutions (0.6-0.7 g per 10 l of water) in sweet pepper variety Dar Tashkent has a positive effect on growth , development of plants, resulting in the formation of tall (86 cm) with the largest leaf surface (0.71 m^2), powerful tops (905 g) and root system (191 g), productivity (917 g) and marketable yield (34.7 t/ha). At the same time, the yield increase amounted to 5.9-8.8 hectares.

Key words: *Capsicum annuum*; gibberellin; root; leaf; fruit; yield

INTRODUCTION

The Kashkadarya region in Uzbekistan is characterized by specific soil and climatic conditions, a low level of pepper vegetable production from the needs of the population, and the yield does not exceed 20-25 tons per hectare. In the republic, tomato production in 2020-2022 averaged 2.0 - 2.3 million tons, pepper 270-280 thousand tons, eggplant 180-200 thousand tons, the bulk was exported abroad.

In the developed countries of the world - China, Mexico, Indonesia, Turkey, Spain, Egypt, the Netherlands and others, as a result of comprehensive studies of biology, biochemistry, agricultural technology, seed production of varieties and heterotic hybrids of sweet pepper, which ensured a stable and high-quality crop in specific conditions (Petkova et al., 2014; Denev et al., 2019; Sobczak & Sobczak, 2019; Mamphogoro et al., 2020; Bogueva et al., 2021; Djinovic et al., 2021).

Many varieties of sweet pepper were brought to us in 1860-1870 from Bulgaria. Many varieties have been created on the basis, of which Bolgarsky 79, Bolgarsky 84 and others were grown until 2000 (Ostonakulov et al., 2019).

The fruits of sweet pepper are rich in carbohydrates, proteins, fats (Lushchits, 2001). According to the biochemical composition, nutritional value, transportability and shelf life, sweet pepper differs significantly from other vegetables. In Uzbekistan in terms of dry matter content (14.5%), it ranks second among vegetables (after garlic), while according to the content of vitamin C (ascorbic acid) it ranks first.

The fruits of sweet pepper, grown in our country, during the period of technical ripeness contain 54-118 mg/%, and during the period of physiological ripeness 368-535 mg/% of vitamin C (Ostonakulov et al., 2019).

In specific conditions, the possibility of growth the production of sweet pepper is to expand the area under crops and rise yields. The main way to increase yields and obtain products suitable for export, a special place is occupied by the correct selection of adaptive, highly productive varieties, the improvement of agricultural cultivation technology, in particular the rational use of organic and mineral fertilizers and growth stimulants (Ostonakulov et al., 2019; Sobczak et al., 2020; Sharma et al., 2020; Rasulov, 2021).

However, under the conditions of irrigated light gray soils of the Kashkadarya region, studies on the evaluation of varieties and improvement of agricultural technology of cultivation have not been carried out yet.

The purpose of the research is to study the phenology and productivity of the sweet pepper variety Dar Tashkent at various rates of fertilizers and growth stimulants. On their basis, to improve the agricultural technologies for the cultivation of this variety to obtain a high marketable production.

MATERIALS AND METHODS

To achieve this goal, in 2021-2022, we conducted field experiments in the conditions of irrigated light gray soils of the Khodzhaev Abdurasul farm of the Shakhrisabz district in Uzbekistan.

The object of research was the variety of sweet pepper, Dar Tashkent, widely distributed in the republic. The variety was bred at the Research Institute of Vegetables, Melons and Potatoes by the method of individual selection from a hybrid combination of varieties Kolokolchik and Moldova 118. Medium early, plastic, cultivated in all areas. The bush is erect, highly leafy, the color of the leaves is green. The fruit is cone-shaped, medium in size, the color of the fruit in technical ripeness is light yellow, and in biological ripeness it is red. Fruits are 3-4-chambered, juicy, with mass - 80-100 g and wall thickness - 5 mm. Productivity is high (25-35 t/ha).

In the experiment, planting seedlings with 4-5 true leaves was carried out on May 2-3 according to the scheme 90x25 cm. When planting seedlings, 6 options were laid, that is, variant 1 brought in only 20 t/ha of manure; option 2, only $N_{200}P_{160}K_{100}$ kg/ha was applied; Variant 3 was applied jointly at the rate of 20 t/ha of manure + $N_{200}P_{160}K_{100}$ kg/ha; 4-variant, only 20 t/ha of manure + gibberellin were applied; variant 5, only $N_{200}P_{160}K_{100}$ kg/ha + gibberellin were applied; 6-variant 20 t/ha manure +$N_{200}P_{160}K_{100}$kg/ha+gibberellin. Mineral fertilizers were used in the form of ammonium nitrate, ammophos and potassium chloride, and manure - from cattle.

The area of the plot for fertilizer is 288 m^2 (7.2x40 m), for growth stimulant 144 m^2 (7.2x20 m), 4-fold repetition. Each plot was divided by fertilizer into 2 parts, first without treatment with growth stimulant solution (control), and second part was treated with growth stimulator solutions (0.6-0.7 g of gibberellin was added to 10 l of water) during the flowering period of plants (worker consumption solution per 1 ha 300 l).

To establish the influence of the studied methods, we studied the survival rate of seedlings on the 5th day after planting in the field, the duration of the growing season, at the beginning of the first collection during the period of technical ripeness, plant height, leaf surface area, weight from 1 bush-roots, tops, fruit yield and average weight of 1 fruit from a bush.

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; Litvinov, 2011; State register, 2022).

All data were processed according to B.A. Dospekhov by the method of dispersion analysis and the accuracy of the experiment and $LSD_{0.5}$ were taken into account (Dospekhov, 1985).

RESULTS AND DISCUSSION

In the republic, research on the culture of sweet pepper was carried out by N. N. Balashev, B. Zh. Azimov, T. E. Ostonakulov, F. F. Rasulov in the field of breeding, seed production and the development of individual elements of cultivation technology (terms, schemes and planting densities, irrigation regime, application of nitrogen, phosphorus

fertilizers, etc.). However, under the conditions of irrigated light gray soils of the southern region of Uzbekistan, the study of sweet pepper at various norms of organomineral fertilizers and the use of growth stimulants has not been carried out.

According to the results of the study, it was found that on the 5th day after planting seedlings of the sweet pepper variety Dar Tashkent, the survival rate of seedlings according to the experimental options was 94.2 - 96.4% (Table 1). A tendency was noted that the use of mineral, especially organomineral fertilizers increases the survival rate of seedlings. The period from planting seedlings of sweet pepper in an open field to the first harvest, that is, the growing season in the variant with the introduction of only 20 tons of manure was 66 days, in the variant only $N_{200}P_{160}K_{100}$kg/ha - 69 days, and in the variants where the joint application of organomineral fertilizers - 70 days, that is, the growing season was extended by 3-4 days. When plants are treated during the flowering period with a solution of growth stimulant (gibberellin) 0.6-0.7 g per 10

Table 1. Growth, bush formation and productivity indicators of the Dar Tashkent sweet pepper variety at various rates of fertilizers and application of growth stimulant (2021-2022)

№	Fertilizer rates, t (kg) / ha	Treatment with solution of growth stimulant	Seedling survival rate %	Vegetation period, in days	Plant height, cm	Leaf area per plant, m^2	Mass per plant, g			Average fruit mass per plant, g
							Root system	Bush	Fruits	
1	**20 t/ha manure**	**Untreated (control)**	94,2	66	68	0,49	167	768	802	103
2	**$N_{200}P_{160}K_{100}$**		95,4	69	75	0,57	179	834	856	107
3	**20 t/ha manure + $N_{200}P_{160}K_{100}$**		96,0	70	80	0,66	188	880	893	110
4	**20 t/ha manure**	**Gibberellin (0.6-0.7 g per 10 l of water)**	95,1	68	71	0,53	171	791	839	106
5	**$N_{200}P_{160}K_{100}$**		96,0	72	79	0,64	186	876	888	112
6	**20 t/ha manure + $N_{200}P_{160}K_{100}$**		96,4	74	86	0,71	191	905	917	115
			LSD_{05}=		**1,7-3,2**	**0,23-0,35**	**1,8-3,0**	**12-18**	**14-23**	

Table 2. The yield of sweet pepper variety Dar Tashkent, depending on the norms of fertilizers and growth stimulant

№	Fertilizer rates, t (kg) / ha	Treatment with solutions of growth stimulant	Total yield by year, t/ha		Average total yield, t/ha	Average marketable yield		Increased marketable yield over control			
								By fertilizer		by growth stimulant	
			2021	2022		t/ha	%	t/ha	%	t/ha	%
1	**20 t/ha manure**	**Untreated (control)**	27,4	25,6	26,5	25,3	95,6	-	100,0	-	100,0
2	**$N_{200}P_{160}K_{100}$**		30,7	28,1	29,4	28,3	96,2	3,0	111,9	-	100,0
3	**20 t/ha manure + $N_{200}P_{160}K_{100}$**		34,5	31,7	33,1	32,2	97,4	6,9	127,3	-	100,0
4	**20 t/ha manure**	**Gibberellin (0.6-0.7 g per 10 l of water)**	30,1	27,3	28,7	27,7	96,5	2,4	109,5	2,4	109,5
5	**$N_{200}P_{160}K_{100}$**		34,2	31,0	32,6	31,7	97,1	6,4	125,3	3,4	112,0
6	**20 t/ha manure + $N_{200}P_{160}K_{100}$**		37,8	32,8	35,3	34,7	98,3	9,4	137,2	2,5	107,8
		LSD_{05}=	**2,6**	**1,9**							

liters of water, the growing season is extended by 2-4 days.

The combined application of 20 tons of manure + $N_{200}P_{160}K_{100}$ kg/ha in the norm and treatment of plants during the flowering period with a solution of growth stimulant (gibberellin 0.6-0.7 g per 10 l of water) increases the resistance of sweet pepper plants to adverse conditions, the growth and development of plants in significantly changes, formed by tall (86 cm), high leaf area (0.71 m^2), powerful tops (905 g) and root system (191 g), the highest productivity (917 g). At the same time, the mass of

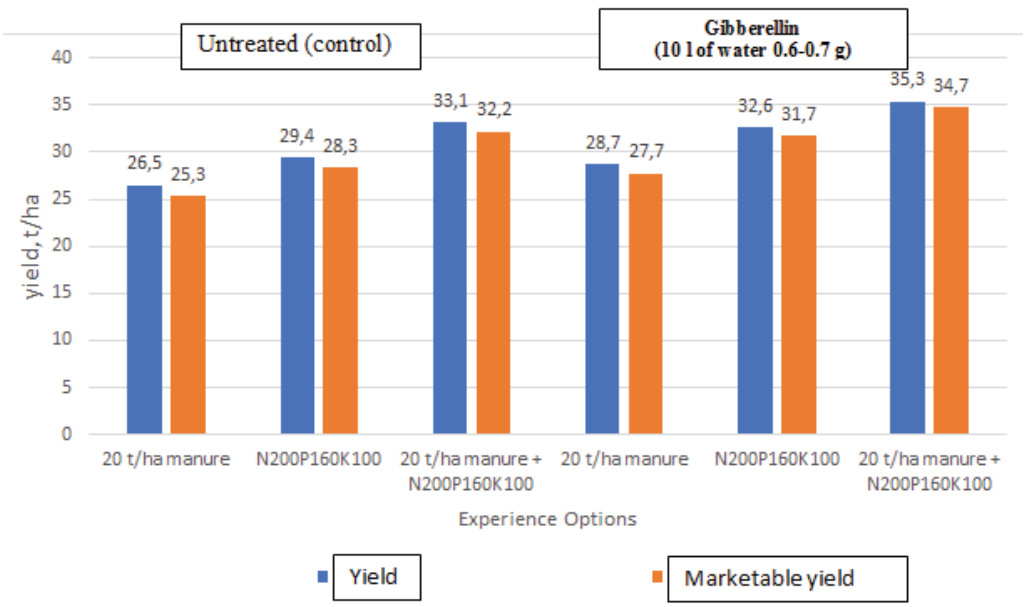

Figure 1. Yield and marketable yield, t/ha

Figure 2. Fruits of the Dar Tashkent variety a) on the left - at the beginning of technical (weight of 5 fruits 570.4 g) and b) on the right – at biological ripeness (weight of 3 fruits 554.4 g) in the variant with the joint application of organomineral fertilizers and treatment with solutions of growth stimulant

technical ripeness of fruits was 115 g, 3-12 g more than other studied options.

The total yield according to the variants of the experiment ranged from 26.5 to 35.3 tons (Table 2). The highest yield (35.3 t/ha) of the sweet pepper variety Dar Tashkent was obtained with the joint application of organomineral fertilizers at a rate of 20 tons of manure + $N_{200}P_{160}K_{100}$ kg/ha and treatment with solutions of growth stimulant (gibberellin 0.6-0 .7 g per 10 l of water). The increase in yield compared to individual applications of organic and mineral fertilizers amounted to 5.9-8.8 t/ha, and in this variant the largest marketable yield was also noted 34.7 t/ha or 98.3% (Figure 1, 2).

CONCLUSIONS

The results showed the growth and development of plants in significantly changes depending on the kind and rate of the fertilizers and the usage of growth stimulant. The best variant was jointly organomineral fertilization at a rate of 20 t/ha of manure + $N_{200}P_{160}K_{100}$ kg/ha and application during the period flowering with solutions of growth stimulant (gibberellin 0.6-0.7 g per 10 liters of water). In it the plants were tall (86 cm), with big leaf area (0.71 m^2), powerful tops (905 g) and root system (191 g), and the highest productivity (917 g). At the same time, the mass of technical ripeness of fruits was 115 g.

It is recommended this variant also for the possibility of obtaining a high and stable marketableproduction (34.7 t/ha) of Dar Tashkent sweet pepper variety in the conditions of irrigated light gray soils of the Kashkadarya region.

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