

Influence of the irrigation regime on the yields of tomatoes and green beans in open areas, with sprinkler irrigation

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Summary

The aim of the study was to establish the influence of the irrigation regime on the yields of tomatoes and green beans, irrigated by sprinkling in open areas.

In order to achieve the set goal on a leached cinnamon forest soil in the area of the Sofia irrigation system (experimental field Chelopechene (IHM) now ISSAPP "N. Pushkarov") a field experiment was carried out with tomatoes of Balkan variety and green bean variety "Nikos", grown at varying degrees of satisfaction of their water needs. The maximum evapotranspiration was determined by compensatory lysimeters, as in options 3 and 4 it was reduced by 20 and 40%, and in option 1 it was increased by 20%. compared to the version with 100% ETM.

Two of the years in which the field experiments were conducted in terms of the amount of precipitation are very dry with a security of 88.7% and 86.7%, and one year is an average with a security of 51.0%. The high temperatures during these years, combined with the lack of rainfall have predetermined the need for irrigation of vegetable crops.

According to the amount of precipitation during the vegetation period of tomatoes, on average for the study period 8 irrigations with irrigation rate of 373 mm were realized in variant (120% ETM), and in green beans for the same variant 6 irrigations with irrigation norm 300 were realized. mm.

The highest total and additional yield is obtained with irrigation with 120% ETM in both crops 7800 kg / dka. (tomatoes) and ETM 240 kg / (green beans) on average for the study period.

It was found that the reduction of the irrigation rate leads to a corresponding reduction, but not in proportion to the reduction of the possible maximum yield. In all cases, the reduction in yield is less than the reduction in the irrigation rate for both crops.

Introduction

Irrigation of vegetable crops is an opportunity to overcome the effects of droughts. Providing the necessary moisture in the soil helps to increase their productive capacity. It compensates for the lack of moisture and allows the realization of the full genetic potential of plants

In modern agriculture, the issues of economical use of scarce water resources for irrigation are becoming increasingly important, which requires establishing the impact of irrigation on crop yields. Characteristic of these crops is that they have a shallower root system with more low suction power, develop a large above-ground mass and form many fruits with a higher water content, which requires them to be grown mainly under irrigated conditions, providing such quantities of irrigation water at which to obtain stable yields.

The main goal of the study is to establish the influence of the irrigation regime on the yields of tomatoes and green beans, irrigated by sprinkling open areas.

Material and method

In order to achieve the set goal, a field experiment was carried out on leached cinnamon forest soil in the area of the Sofia Irrigation System with tomatoes of the Balkan variety and green beans of the Nikos variety, grown at different degrees of satisfaction of their water needs.

The research was conducted on the experimental field Chelopechene (IHM) now ISSAPP "N. Pushkarov", Sofia on leached cinnamon forest soil.

The following irrigation variants were tested in both crops:

1. variant 120% ETM (maximum evapotranspiration);
2. variant 100% ETM (maximum evapotranspiration);
3. variant 80% ETM (maximum evapotranspiration);
4. variant 60% ETM (maximum evapotranspiration).

Evapotranspiration is determined by water balance calculations based on the available soil moisture at the beginning and end of the growing season, rainfall and the number of irrigations.

The maximum evapotranspiration was determined by compensatory lysimeters, as in options 3 and 4 it was reduced by 20 and 40%, and in option 1 it was increased by 20%. compared to the version with 100% ETM.

Irrigation in all variants was carried out with an irrigation rate of 40 mm, and the water balance calculations were made for a soil layer of 0-60 cm. Irrigation is done by sprinkling. The yields of the

obtained variants were processed by the method of analysis of variance (Shanin, 1977)

The years in which the field experiments were carried out in terms of the amount of precipitation, two of the years were very dry with a security of 88.7% and 86.7%, and one was an average with a security of 51.0%. The high temperatures during these years, combined with the lack of rainfall have predetermined the need for irrigation of vegetable crops.

Results obtained

From previous studies (Delibaltov, 1980) in vegetable crops, it was found that the highest biological yields are obtained by maintaining a higher pre-irrigation humidity, which is more frequent watering. According to the amount of rainfall during the growing season of tomatoes, on average for the study period were realized 8 irrigations with an irrigation rate of 373 mm in variant (120% ETM), and for green beans for the same variant were realized 6 irrigations with irrigation rate 300 mm.

Two of the years of research were dry, which required up to 11 waterings for tomatoes and up to 8 waterings for green beans. Irrigation and rainfall during the growing season of vegetables have affected the obtained yields. On average for the study period, the highest yield of tomatoes was obtained in variant 1, irrigated on the basis of 120% ETM -7800 kg / dka.

In the variants irrigated with 20 and 40% ETM reduction, yields were 9 and 13% lower compared to variant 2 (100% ETM) (Table 1).

In the case of green beans, the highest yield was also obtained in variant 1, irrigated on the basis of 120% ETM 240 kg / dka, and in the variants irrigated with 20 and 40% reduction of EMT, yields with 5 and 15% lower yields were obtained. compared to option 2 (100% ETM). (Table 2).

Indicative of the influence of the reduction of the irrigation norm for tomatoes and green beans are the obtained results of the water-yield dependence. The results show that the reduction of the yields obtained from both crops does not correspond to the reduction of the irrigation norms. It was found that the reduction of the irrigation norm leads to a corresponding reduction, but not proportional to the reduction of the possible maximum yield. In all cases, the decrease in yield is less than the decrease in the irrigation rate for both crops (Table 1.2).

When the irrigation rate is reduced by 20%, the yields decrease from 5% (green beans) to 9% (tomatoes), and when the irrigation rate is reduced by 40%, the yields decrease from 13% (tomatoes) to 15% (green beans) (tab.1.2).

Table 1. Water-yield dependence of tomatoes on average for the study period

variants	yield		irrigation norm	
	kg/dka	%	m ³ /dka	%
120% EMT	7800	114	373	120
100% EMT	6840	100	333	100
80% EMT	6340	92	266	80
60% EMT	5970	87	219	60

Table 2. Water-yield dependence of green beans on average for the study period

variants	yield		irrigation norm	
	kg/dka	%	m ³ /dka	%
120% EMT	720	105	300	120
100% EMT	680	100	260	100
80% EMT	650	95	650	80
60% EMT	580	85	580	60

With a 20% increase in the irrigation rate for both crops, the yield increased by 14% for tomatoes, and for green beans - by 5%, which does not justify the cost of irrigation.

On average for the study period, with a reduction in the irrigation rate for tomatoes by 20%, the yield decreased by 8%, and with a 40% reduction, the yield decreased by 13%. For green beans with 5 and 15, respectively, Tables 1 and 2)

Indicative of the effect of irrigation of vegetable crops is the relationship between irrigation rate and additional production. The additional yield is compared with option 4 (60% ETM)

The irrigation rate realized in variant 1 (120% ETM) in both crops has ensured the highest additional yield, which amounts to 1830 kg / dka of tomatoes and 140 kg / dka of green beans. The higher additional yield of tomatoes shows that the production of this crop is obtained from significant amounts of water. The reduction of the irrigation rate by 20 and 40% has led to a reduction of the additional yield from 6 to 37.7% for tomatoes and from 12 to 24% for green beans (Table 1.2).

The data for both crops show that with increasing irrigation rate, yields increase, which shows that vegetable production is obtained from significant amounts of water, which is greatly influenced by the nature of the meteorological complex of the year.

The reduction of the irrigation rate by 20% in both crops leads to a different reduction in their yields. In the case of green beans, this reduction leads to insignificant yield losses of 5-6%, while in the case of tomatoes these losses are from 14 to 19%, which is due to the greater moisture content.

Conclusions from the study

Irrigation of vegetable crops is a mandatory event in countries with a semi-arid climate, such as that in Bulgaria.

The highest total and additional yield is obtained by irrigation with 120% ETM in both crops.

The reduction of the irrigation norms in both crops leads to a corresponding reduction of the possible maximum yield, but not proportionally.

The reduction of yield in both crops is less than the reduction of the irrigation rate, which in a thorough economic analysis will make these options economically viable for the consumer.

The irrigation rate realized in variant 1 (120% ETM) in both crops has ensured the highest additional yield, which amounts to 1830 kg / dka tomatoes and 140 kg / dka green beans

The reduction of the irrigation rate by 20 and 40% has led to a reduction of the additional yield from 6 to 37.7% for tomatoes and from 12 to 24% for green beans.

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