RESEARCH REGARDING THE EFFECT OF IRRIGATION ON THE LEAF SURFACE OF PLUM SEEDLINGS IN THE SECOND FIELD

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RESEARCH ARTICLE

Abstract
The growth of horticultural plants is affected by high temperatures and drought, through the inhibitory effects they have on cell division and extension, as well as on some morphological changes regarding the increase in thickness of the leaves and the cuticle, the reduction of the number of stomata, wilting, change in position of the leaves on the plant and the change in the number of aquaporins. The current work is a research on the influence of irrigation in the nursery, on plum seedlings. Plum rootstocks are demanding in terms of water, their culture being extended over larger areas in areas with a richer pluviometric regime. From the large amount of water absorbed from the soil by the roots, for the synthesis of organic substances, the rootstock uses only a small part, the rest being eliminated through the phenomenon of transpiration. Two varieties of plum were studied, namely Cacanska Lepotica and Stanley. Four irrigation norms were used in the research. The leaf surface of the seedlings, under the effect of different watering norms, the average leaf surface, the effect of irrigation and the variety on the leaf surface were analyzed.

Keywords: irrigation rate, seedlings, leaf surface, Cacanska Lepotica, Stanley
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INTRODUCTION

Water is indispensable for plants, being a basic component of living cells and tissues. Only in the presence of water can the processes of assimilation and disassimilation and gas exchange take place. Once inside the plant, water keeps the cell walls stretched and gives the cells and tissues turgidity, which ensures the mechanical balance of the various organs (Sela, 2020). Together with dissolved substances, water determines the osmotic pressure of cells and tissues, ensuring intercellular exchanges. As a participant in plant metabolism, water is involved in the fundamental processes of the living world, photosynthesis, respiration, transpiration. The importance of water as a vegetation factor in the life of plants is known and appreciated as such from the moment when man began to practice agriculture and horticulture. With the deepening of agronomic and horticultural knowledge and with the progress made in the related fields (plant physiology, pedology, climatology, biophysics, etc.), some clarifications and differentiations of water requirements for agricultural and horticultural crops could be made. The water in plants is found in different states: a part of the water enters the structure of all the chemical compounds of the organic matter, another part is represented by water very tightly bound osmotically and by biocolloids and another part of the water that is found in the vessels and cells plants, being very weakly retained, is mobile and moves from cell to cell or from one organism to another, under the effect of forces acting inside or outside the plant organism (Panigrahi, 2020). For a normal development of plants, a high water content in their tissues is necessary, which is achieved by continuously maintaining a high humidity in the soil (Goyal, 2021). Corresponding to the interaction of influencing factors, the water consumption requirements specific to fruit plants vary within relatively wide limits according to the species and variety, parent stocks, the age period of the plants and the vegetation phase, the climatic factors through the precipitation regime, the thermal and wind regime, the factors pedological through the orography of the land, the state of fertility and the technological factors through the culture system and the technical level practiced. Through irrigation, an optimal water supply level of 65-75% of the soil's total retention capacity must be ensured, by no means creating excess moisture (>80%). Our country, due to its geographical location at the confluence of continental and Mediterranean climates, generally offers favourable climate and soil conditions for a large number of fruit nurseries. Numerous autochthonous varieties attest to the presence of fruit growing on the lands of our country since ancient times. Initially, the fruit nurseries were concentrated in the areas with a richer rainfall regime, so that the rootstock capture depended to a greater extent on the rainfall regime, the human intervention at the beginning being modest in this regard (Steele, 2015)

A shortcoming characteristic of the climatic regime of our country, which is reflected quite significantly in fruit growing, is the defective distribution of precipitation during the year, resulting in prolonged periods of drought in some areas (periods of time longer than 10 days during the vegetation and 14 days during rest, in which no rains greater than 5 mm fall) (Twoney, 2016). Taking into account these aspects, associated with the tendency to develop important fruit-growing centres in typically dry areas, on zonal soils and on sands, it is found that irrigation must be a concern of prime importance for the fruit-growing sector in our country, but which must manifest itself differently, depending on the pedoclimatic zone, type of rootstock, etc. Plum rootstocks are demanding in terms of water, their culture being extended over larger areas in areas with a richer pluviometric regime (Novelli, 2022). From the large amount of water absorbed from the soil by the roots, for the synthesis of organic substances, the rootstock uses only a small part, the rest being eliminated through the phenomenon of transpiration. In the case of planting rootstocks on wet and poor soils where the soil solution has a lower concentration of fertilizing elements, the transpiration coefficient is higher than in the case of rootstocks planted on more fertile soils (Kun, 2022). By applying fertilizers and ensuring sufficient amounts of water in the soil, the transpiration coefficient decreases so that water is used more economically by the rootstock (Faulkner, 2022). Irrigation represents both an important technological sequence in the agrotechnology of crop plants, as well as the most important means of eliminating the water deficit in the soil, constituting the infrastructure of sustainable development (Zai, 2022). Irrigation also means the controlled supply of soil and plants with additional amounts of water compared to those received naturally, in order to ensure the constancy of agricultural production at a high level. Finally, the aim is to create the conditions for the practice of efficient, sustainable agriculture, under the conditions of protecting the environmental factors. Among these factors, a primary role belongs to the soil, whose fertility must be maintained at a high level and even improved. The use of this radical method of fighting drought, which is irrigation, is indicated to be associated in the complex with other technical-agricultural measures, including drying works (where applicable), fertilizing, selection of the most valuable plants and varieties, etc. At the same time, irrigation can also be defined as the set of works and measures that compete for the controlled supply of water to plants in order to obtain high, constant and quality productions. In our country, the development of irrigation at the moment is characterized by the following two main features: very intense pace in the development of new lands and the use of modern solutions in the construction of irrigation systems. In this way, fruit growing will cease to be tributary to the biggest enemy of agriculture, the drought. However, the action to remove the moisture deficit does not stop at landscaping. The creation of the irrigation system constitutes a first stage, after which an equally important stage follows, that of exploitation, of putting the respective facilities into maximum efficiency. This second, long-lasting stage, involves the application of irrigation in such a way that once the expected results are achieved in the production of trees, the maintenance of the soil in a state of permanent fertility and the irrigation system in a perfect state is ensured operation. In the climatic conditions of our country, irrigation is a measure to supplement the quantities of water that come naturally, from precipitation, in periods when they are insufficient compared to the requirements of crops. It is, in fact, a means used to correct a natural factor, which, as it is presented, has the effect of large fluctuations in the harvest from one year to another. Through the use of irrigation, the aim is to obtain the most stable productions, close to the productive potential of the plants in the given pedo-climatic conditions. This, of course, all the more since, during the research carried out in our country, it was found that there are years in which, due to insufficient rainfall in certain periods, harvests are greatly reduced, going up to total compromise.

MATERIAL AND METHOD

The key research methods employed were analysis and synthesis and analogy to resemble the results.

RESULTS AND DISCUSSIONS

According to the results of the analysis of variance, it can be observed that only irrigation and fertilization showed considerable, statistically guaranteed influences on the leaf surface of seedlings in field II. Irrigation had the highest contribution to this character (30.75 %), compared to fertilization treatments (22.07 %), against the background of a very small influence of the variety (0.11 %). Also, the combined effects of the three factors showed significant influences on the leaf surface, but considerably less than their separate effects. The interaction between variety and irrigation was highlighted by a major effect of 3.64%, followed by the fertilization x variety interaction.

Table 1

Variance Analysis Regarding the Effect of Irrigation, Variety and Fertilization on the Leaf Surface of Seedlings from the Second Field

The source of variation	SP	GL	S^2	Test F
Total	43868124	159		
Repetition	216761	4	54190	0,59
Irrigation	8493021	3	2831007	30,75**
Irrigation error	1104856	12	92071	
Variety	9986	1	9986	0,12
Irrigation x Variety	970711	3	323570	3,84*
Type error	1349748	16	84359	
Fertilization	9982917	3	3327639	22,07**
Irrigation x Fertilization	3044252	9	338250	2,24*
Variety x Fertilization	1398818	3	466273	3,09*
Irrigation x Variety x Fertilization	2819710	9	313301	2,08*
Fertilization error	14477344	96	150806	

Taking into account the unilateral effect of irrigation, it is observed that the leaf surface recorded an amplitude of 610 cm² with values between 4275 cm² in the non-irrigated version and 4885 cm² in the case of using the 30 mm watering norm. As such, the three watering norms showed major and strongly statistically assured influences, determining progressive increases of this character between 4.42 and 14.27%. Changing the watering rate from 10 to 20 mm had a significant effect associated with an increase in leaf area of 5.17%, while the addition of irrigation from 20 to 30 mm determined a significant increase of this character of 4.05 %.

Table 2

The Average Leaf Area of Seedlings in the Second Field under the Effect of Different Irrigation Rate

Irrigation rate	Leaf surface (cm^2)		Relative values (%)	Difference/ Significance
10 mm – 0 mm	4464	4275	104,42	189*
20 mm – 0 mm	4695	4275	109,82	420***
30 mm – 0 mm	4885	4275	114,27	610***
20 mm – 10 mm	4695	4464	105,17	231**
30 mm – 10 mm	4885	4464	109,43	421***
30 mm – 20 mm	4885	4695	104,05	190*

Regarding the individual effect of the varieties, the leaf surface recorded an amplitude of 15 cm²) and very low variability, with limits from 4572 cm² in the case of Stanley seedlings to 4587 cm² in the case of Cacanska Lepotica. Thus, at the level of the entire experience, it is confirmed that, against the background of the climatic conditions in field II, the variety did not significantly influence the development of the leaf apparatus in the seedlings.

Table 3

The Average Leaf Surface of the Seedlings of the Two Varieties in the Second Field – Individual Effect

Variety	Leaf surface (cm^2)		Relative values (%)	Difference/ Significance
Cacanska Lepotica - Stanley	4587	4572	100,33	15

Considering the effect of the interaction between the varieties and irrigation on the leaf surface of the seedlings in field II, it follows that in the case of the Cacanska Lepotica variety, the three watering norms generated significant variations compared to the non-irrigated variant. against the background of statistically ensured differences and between watering rules.

The seedlings of the Stanley variety efficiently utilized only the norms of 20 and 30 mm which determined significant increases of this character compared to the control variant, while the effect of the norm of 10 mm was insignificant and less than in the Cacanska Lepotica variety.

Considering the interaction between irrigation and leaf surface in the seedlings of the Stanley variety, it is observed that only irrigations with 20-30 mm allowed a significant variation of 7.76-11.7%, while the effect of the watering rate of 10 mm was smaller and insignificant. Also, only increasing the watering rate from 10 to 30 mm determined a significant increase of 7.18% of this character.

Under the effect of different watering norms, the seedlings of the Cacanska Lepotica variety recorded a leaf surface with limits from 4234 cm2 in the case of the non-irrigated variant, to 4821 cm2 in the 30 mm variant, against the background of a variability between treatments of 9.5%. Compared to the non-irrigated agro-fund, in the seedlings of this variety, the three watering norms generated significant increases of 4.61-16.86%. The progressive modification of the watering norm by 10 mm determined significant variations of this character of 210-309 cm2.

Table 4

The Effect of Irrigation and Variety on the Leaf Surface in the Second Field

Variety	Irrigation rate					
	0 mm	10 mm	20 mm	30 mm		S%
Stanley	z 4316 a	yz 4498 a	xy 4651 a	x 4821 a	4572±41	7,94
Cacanska Lepotica	u 4234 a	z 4429 a	y 4738 a	x 4948 a	4587±49	9,50
	4275±44	4464±46	4695±54	4885±62	4580±32	
S%	6,46	6,52	7,32	8,06	8,73	

The relationship between the watering rate and the variation of the leaf surface in the Cacanska Lepotica seedlings is highlighted with a precision of approximately 99.25% by means of an exponential function. Thus, against the background of average values of 4226 cm2 in the absence of irrigation, the average growth rate of this character was 16.83 cm2/mm of watering, with small variations from one norm to another (15.3-18.2 cm/mm of watering).

CONCLUSIONS

In the seedlings of the Cacanska Lepotica variety, irrigation had a higher effect on the leaf surface. Regarding the individual effect of the varieties, the leaf surface recorded an amplitude of 15 cm^2) and very low variability, with limits from 4572 cm^2 in the case of Stanley seedlings to 4587 cm^2 in the case of Cacanska Lepotica. Considering the effect of the interaction between the varieties and irrigation on the leaf surface of the seedlings in field II, it follows that in the case of the Cacanska Lepotica variety, the three watering norms generated significant variations compared to the non-irrigated variant. against the background of statistically ensured differences and between watering rules. The seedlings of the Stanley variety efficiently utilized only the norms of 20 and 30 mm which determined significant increases of this character compared to the control variant, while the effect of the norm of 10 mm was insignificant and less than in the Cacanska Lepotica variety. Under the effect of different watering norms, the seedlings of the Cacanska Lepotica variety recorded a leaf surface with limits from 4234 cm^2 in the case of the non-irrigated variant, to 4821 cm^2 in the 30 mm variant, against the background of a variability between treatments of 9.5%. Compared to the non-irrigated agro-fund, in the seedlings of this variety, the three watering norms generated significant increases of 4.61-16.86%. The progressive modification of the watering norm by 10 mm determined significant variations of this character of 210-309 cm^2.

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