IRRIGATION REGIMES AND YIELD OF BERRIES IN DRIP IRRIGATION CONDITIONS AND WATER DEFICIT

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Summary: *The increasing water deficit requires studies to optimize irrigation regimes and water-saving technologies to achieve economy of irrigation water at an acceptable yield level.*
In order to establish the irrigation regime in the field of "Chelopechene" Experimental Field, Sofia, there have been researches, examining different regimes - from full satisfaction of the daily needs of culture for water to irrigation with reduced by 20% and 40% water application rates.
On average, over the survey period, the highest yields were obtained with the irrigated wit 100% water applicatipn rate. Reducing the irrigation rate leads to a corresponding reduction in yields and affects the quality of production. The application of regimes of irrigation with reduced iwater applicatipn rates is recommended only in the case of water deficiency.
KEY WORDS: *DRIP IRRIGATION, IRRIGATION REGIMEN, BERRY CROPS, YIELD, RASPBERRIES, STRAWBERRIES, EXPERIMENT*

1.Introduction

Climate change due to global warming has a significant impact on water resources, including groundwater and surface water (Ziad A.M. and S.A. Jamous, 2010). The periods of drought vary with duration and time of manifestation.
The aggravated conditions in agriculture as a result of climate change necessitate the use of appropriate systems and technologies for growing and irrigating agricultural crops, taking into account soil, climate and new economic conditions. Under the new conditions of agricultural development, water appears to be a limiting factor and becomes extremely important from an environmental and economic point of view. It is also a decisive factor for showing the maximum productive capacity of agricultural crops with the optimal supply of plants with water.
Micro-irrigation in these crops is increasingly used, due to the possibility of effective control of processes in the irrigation system and in the irrigated plantation (Bucks et al., 1982). This method fully complies with the requirements for sustainable agriculture and organic fruit production, incl. ensures high yields and quality of production, reduces unwanted side effects. (Branson et al., 1981). Currently drip irrigation is a proven water-saving technology that meets the requirements for sustainable agriculture and protection of water resources and the environment, which has its place in hydro-ameliorative practice (Petkov, Pl., Etc. 2007).
The aim of the study is to determine the influence of irrigation on the yield of berry crops, optimal water supply and water deficit

2.Materials and methods

For three years, studies have been conducted to establish the dripping regime with regard to the amount of water supplied, the irrigation period, the irrigation rate, and the yields obtained. The researches were conducted in the experimental base of ISSAPP "N.Pushkarov", district "Chelopechene" for years with various meteorological conditions with basic berry crops - raspberries and strawberries on open areas.
Irrigation variants have been tested at a presumptive humidity of 80 ÷ 85% of the total Polish moisture content and watering irrigation rates of satisfying 60 to 100% of the water requirements. The irrigation is carried out with a Drospach Drop System, which best meets the biological features of the crops studied.
The feature of drip irrigation is that the irrigation rate is not the same as other irrigation technologies. A reduction is made at the expense of the not watered area. For this purpose, the formula of (Frecman, B., Carzoli, 1980) was used, taking into account the cropping patterns of the test crops.
The soil is a leavened Leptosols, medium heavy in mechanical composition with a maximum field moisture content of 0 ÷ 0,60 m - 22,1% of the weight of the absolutely dry soil and a dry soil density of 1,47 g / cm3. Suitable for growing berry crops.

3.Results and discussions

Based on the amount and distribution of precipitation during the April-September vegetation period, the conditions during the individual years are characterized by variety and extreme manifestation. Regarding the amount of precipitated rainfall during the growing season of raspberries 1999 and 2001, they are characterized as wet and moderately humid with a factor of rainfall of 19.2% and 33% and 2000 as very dry with a guarantee of 98.6 %. Years of the Polish experiment with Polka strawberries are characterized as very dry with a factor of rainfall from 80.75% (2013) to 86.9% (2012). The lowest rainfall fell in 2011 (244 mm) and 2012. (245 mm), and in 2013 (260 mm).
The precipitation during the growing season of the cultivated crops is unevenly distributed in the different periods, which led to the realization of a different number of irrigation. The crop yields obtained over the years with the different humidity ratios (rainfall factor availability) show the impact of drip irrigation on the yields obtained.
The results show that optimum yields of raspberries and high quality strawberries are obtained at a pre-humid soil moisture between 80 and 85% of the total water holding capacity (WHC) and a 100% water application rate. In the case of 18 irrigations and 324 mm irrigation rate, a yield of Raspberry Raspberry - 10 780 kg / ha (Table 1 and Figure 1) was obtained on average over the period of the survey. The reduction in the irrigation arte by 20 and 40% has led to a reduction in yields of 11 and 22%.
Raspberries and strawberries have different growing seasons, which has influenced the number of irrigations and the size of irrigation regulations. In the cultivation of "Polka" variety strawberries in open areas, 8 numbers of irrigations and irrigation rate of 136 mm were produced yield of 15,180 kg / ha during the study period (Table 1 and Figure 1), followed by variant with 20% reduction of the water application rate - 1142 kg / dka. The lowest yields were obtained with the 40% reduction of the water application rate - 935 kg / dka. Lowering the irrigation rate by 20% resulted in a 25% reduction in yields compared to the 100% realization of irrigated rate. This irrigation regime can be used in the event of an occurrence of water deficit, where the yields obtained are satisfactory. Reducing the irrigation rate by 40% has led to a more drastic reduction in yields of 40%, due to the very dry and hot years of field experiments.

Table 1: *Irrigation regime and yields in berry crops with average drip irrigation during the study period.*

Crops varieties	Number of irrigations	water application rate, mm	Irrigation rate, mm	yield, kg/ha
100% water application rate				
Raspberry variety "Lyulin"	18	18	324	10 780
Strawberry variety "Polka"	8	17	136	15 180
80% water application rate				
Raspberry variety "Lyulin"	18	14	252	9 630
Strawberry variety "Polka"	8	14	112	11 420
60% water application rate				
Raspberry variety "Lyulin"	18	11	198	8 350
Strawberry variety "Polka"	8	10	80	9 350

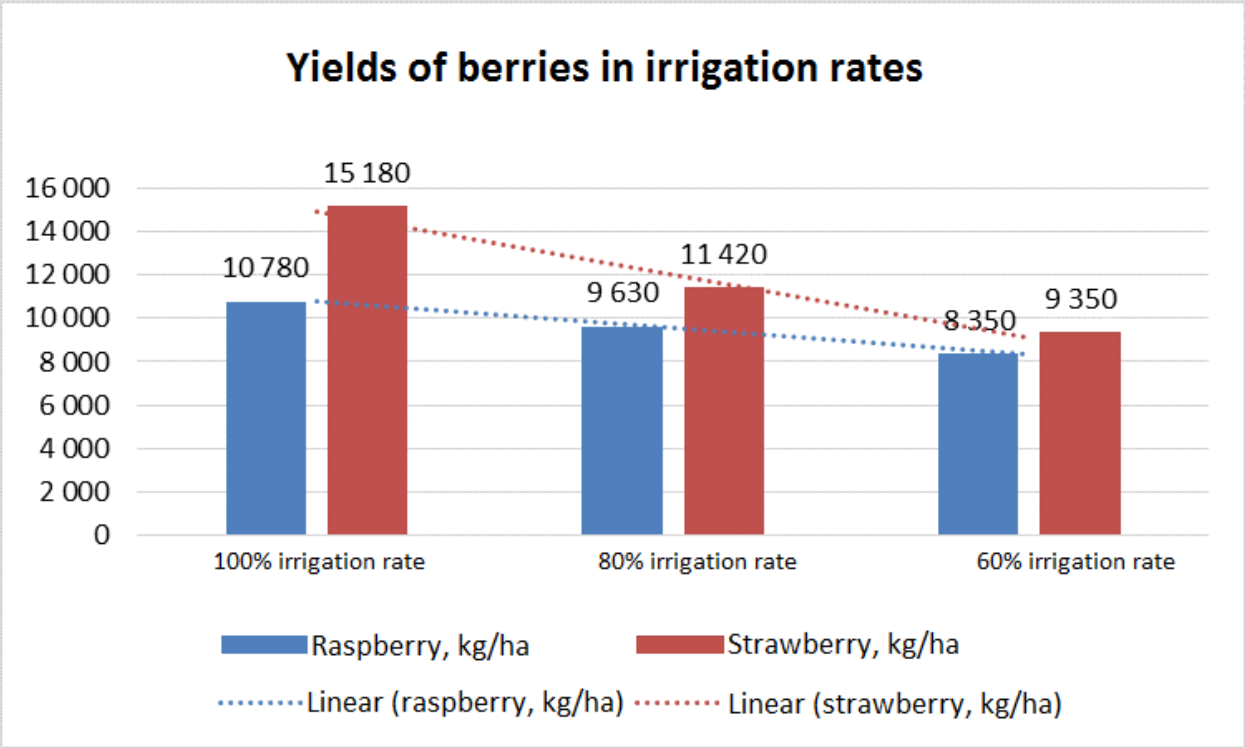

Fig. 1. Yields of berries in irrigation rates of 60%, 80% and 100%

4. Conclusion

1. Research conducted with berry crops in the area of the Sofia field shows that, when maintaining asoil moisture before issigation of 80 ÷ 85% of WHC, high yields are obtained with good quality indicators.
2. From the applied irrigation regimes in the studied crops, on average during the study period, optimal yields are obtained at 100% realization of the water application rate.
3. The reduction of the water application rates by 20% and 40% leads to lower economic results for both crops. In case of water deficit, it is recommended to apply irrigation regime with a 20% reduction of water application rates, where the yields are satisfactory in both studied crops.
4. The results of the field experiments can be used in the design and operation of irrigation systems as well as in determining the economic effect of drip irrigation

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