



Water Demand and Water Consumption of Lemon Plant during the Annual Vegetation Period

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Abstract: the article presents the results of the research conducted in order to study the water demand and water consumption of the lemon plant during the annual vegetation period. Also, the article provides valuable information about water consumption of different irrigation methods and their effect on the productivity of lemon seedlings.

Keywords: lemon, vegetation period, water consumption, lemon seedlings, productivity.

Introduction

In Uzbekistan, great attention is paid to the cultivation of new types and varieties of citrus plants. According to the latest statistics, the demand of the population of the republic for citrus fruits is increasing, and the annual demand of these medicinal fruits per person is 20-30 kilograms. In developed subtropical countries that grow citrus fruits at an industrial level, annual consumption is 120-150 kg per person.

In the favorable climatic conditions and fertile soils of Uzbekistan, the cultivation of these unique fruits in a resource-efficient manner at an industrial level, as well as the development of export competence of citrus fruits, requires the development of a number of agrotechnical measures.

It is known that citrus plants are mainly cultivated in protected facilities in the countries of the Central Asian region. Like all fruit plants, citrus plants also require specific climatic and soil conditions, the correct selection of varieties, their planting methods and schemes, the correct selection of shaping and pruning measures, watering and fertilizing them, studying diseases and pests, picking and storing their fruits, etc. requires proper organization of agrotechnical activities.

Cultivation of citrus plants in a resource-efficient way and reducing the cost of their fruits, as well as increasing their productivity and quality, requires the development of new agrotechnical measures related to their irrigation.

It is known that citrus plants belong to the type of cool-loving and moisture-loving plants, unlike other fruit plants in terms of their biological characteristics. Creating these conditions for plants in the dry and hot climate of Uzbekistan is very difficult and requires special knowledge and experience.

Taking into account that the cultivation of citrus fruits in the republic requires additional labor and costs, the cultivation of these medicinal fruits in many cases falls on private estates and small farmers. One of the most basic and important aspects of growing citrus plants in large areas is the correct organization of their irrigation. It has been proven by many scientists that citrus plants grow

well in conditions with soil moisture not less than 50%, and their rapid development.

A drip irrigation system is a device consisting of a large-sized water storage device and glue pipes, which provides water for each plant by drip, and also saves water by 50-70%. The advantage of drip irrigation is that in drip irrigation, the amount of water that flows out of the drip irrigation is saved by 30%. In such areas, excessive humidity and germination of weeds that spread diseases and pests are prevented. Drip irrigation is widely used in modern agriculture due to its many advantages and advantages. As such, this method is expensive and difficult to apply in large areas.

Drip irrigation method - creates great conditions for all moisture-loving fruit plants. This method mainly irrigates tropical and subtropical fruit plants. By sprinkling, it cleans the leaves of dust, aphids, insects, and diseases and helps to speed up the assimilation process. This, in turn, creates the basis for increased productivity. In this method, the air temperature will decrease slightly due to the increase in air humidity. This method gives good results in the rapidly changing climatic conditions of Uzbekistan. However, when watering in this way, soil moisture cannot be maintained at a constant level for a long time.

Materials and Methods

Scientific research on the influence of irrigation methods and standards on the growth, development, yield and quality of lemon trees, the most widely grown citrus plant, was conducted in 2016-2019 at the central farm of the scientific research institute of horticulture, viticulture and winemaking named after Academician M. Mirzaev.

This important agrotechnical activity was carried out by clarifying the cheap, convenient and effective method of furrow irrigation (control), drip irrigation, sprinkler irrigation.

In order to determine the water demand of lemon plants by varieties, the number and norms of watering in the greenhouse, studies were carried out in the options of watering 12 times during the growing season (control), 20 times during the growing season, and 25 times during the growing season.

Four-year-old seedlings of the small "Meyer" lemon variety, medium-growing local "Tashkent" variety, and strong-growing local "Yubileyni" variety were selected as experimental objects.

The water requirement of the plant was studied in 35 seedlings for each variety. Furrow irrigation was carried out 10 or 12 times during the growing season. The drip irrigation system was used for 3-4 hours every day. The sprinkler irrigation system was implemented every day for 10-15 minutes in the afternoon. During the summer months, when the temperature exceeded 35°C, the sprinkler irrigation system was implemented after sunset.

Irrigation works were mainly determined visually. Irrigation was stopped when the 30-40 cm layer of the soil surface was moistened. In this case, the soil moisture was maintained at a level of not less than 65% for the active work of the root system and rapid development of the plant.

In the greenhouses, regular watering was carried out once every two weeks from September to April of the following year, and twice a week from May to August.

In the greenhouses, air temperature was monitored using a thermograph, and air humidity was monitored using hygrograph meters. The data obtained from the research were processed in the method of dispersion analysis recommended by BA Dospekhov [1].

Results and Discussion

According to the results of the research, when lemon seedlings are irrigated by drip irrigation, the average water consumption for each irrigation operation is 450-500 m³, and the soil moisture is 70-80% of the norm for lemon plants, while the experimental irrigation is economical, and the water consumption in each irrigation operation is 3 times more economical in the drip irrigation method. total was 150-160 m³, and the soil moisture decreased by half compared to the norm and totaled 44-45%.

Table 1 Water consumption of different irrigation methods and their effect on the productivity of lemon seedlings, 2016-2019

Watering methods	Lemon varieties	Water consumption, m ³	Soil moisture, %	Fruits on a bush		
				Number, pieces/bunch	Weight of 1 fruit, grams	Average weight, kg/plant
irrigation by furrow (control)	Meyer	450-500	70-80	145-150	100	15,0
	Tashkent	450-500	70-80	150-155	200	31,0
	Yubileyni	450-500	70-80	138-140	700	98,0
Drip irrigation	Meyer	150-160	44-53	125-130	80	10,0
	Tashkent	150-160	44-53	120-125	150	18,7
	Yubileyni	150-160	44-53	118-120	400	48,0
Sprinkler irrigation	Meyer	235-250	60-70	155-160	100	16,0
	Tashkent	235-250	60-70	155-160	220	35,2
	Yubileyni	235-250	60-70	148-150	800	120,0

In a similar experiment, which is widely used in modern greenhouses, the water consumption was saved twice as compared to the control, that is, despite the fact that 235-250 m³ of water was wasted, the soil moisture was the standard index for lemon plants, i.e. 60-70%.

In a similar experiment, the effect of soil moisture and irrigation methods on the productivity of lemon varieties with different growth rates was also studied.

The results of the experiment show that soil moisture and irrigation methods that shape soil moisture have a significant effect on lemon plant productivity.

In the experiment, it was observed that each irrigation method has its own positive and negative effects on lemon productivity.

In particular, water consumption was 3 times more than that of drip irrigation, and 2 times more than that of sprinkler irrigation. In the experimental method of lemon irrigation, for three years, an average of 15.0 kg of lemon per bush in the Meyer variety and 32.0 kg in the Tashkent variety. and Yubileyni variety yielded an average of 98.0 kg, while these parameters were 10.0 kg per bush of Meyer variety, 18.7 kg on average in Tashkent variety, and 48.0 kg in Yubileyni variety. formed In the method of rain irrigation of lemon, as a result of twice the consumption of water compared to the method of irrigation, almost high productivity was achieved in all varieties. In the experiment, the average productivity of lemon varieties was achieved from 16.0 kg to 120.0 kg, depending on the lemon varieties.

During the research, it was found that water has a great importance in changing the productivity of lemon varieties.

In particular, moderate watering of lemon plants had a positive effect on the weight of the fruits formed in them. In the experiment, the standard weight of the lemon crop was kept by all types of lemons in the methods of irrigation by drip and rain, while it was observed that the weight of the lemon crop decreased significantly in the method of drip irrigation. This, in turn, caused a decrease in the productivity of lemons.

In particular, although the water consumption is 3 times higher in the drip irrigation method than in the drip irrigation method, the productivity of the strong-growing Yubileyni variety is 98.0 kg per bush in the drip irrigation method, only 48.0 kg per bush in the drip irrigation method, and 48.0 kg per bush in the rain irrigation method.

It was found that when growing citrus plants in greenhouses, soil moisture within the specified standards has a great impact on their growth, development and productivity. The presence of soil moisture in the amount of 60-80% in citrus plants, as well as in various fruit plants, has a very positive effect on the normal functioning of the absorbing roots, respiration and the processes of substance exchange in the soil.

Table 2 Determining the water demand and amount of water consumption of the lemon plant during the annual vegetation period, 2016-2019

Months	Air temperature, °C	Phases of development	Number of watering, pcs	Average consumption of water in different irrigation methods, m ³		
				Furrow, (control)	Drip irrigation	Sprinkler irrigation
January	6-10	Stockpiling period	1	400-500	150-160	235-250
February	14-18	The beginning of growth	2	800-1000	300-320	470-500
March	18-24	Flowering period	2	800-1000	300-320	470-500
April	25-28	Fruit formation	3	1200-1500	450-480	705-750
May	30-35	The first formative period	3	1200-1500	450-480	705-750
June August	35-40	A period of strong growth	9	3600-4500	1350-1440	2115-2250
September	30-34	The second formative period	2	800-1000	300-320	470-500
October	16-20	Ripening period	2	800-1000	300-320	470-500
November	10-14	Fruit picking season	1	400-500	150-160	235-250
December	8-10	3the end of the accumulation period	-	0		
Total consumption of water during the growing season			25	10 000	3750	5875

As confirmation of the above, the results of experiments on irrigation methods that maintain soil moisture at the same level and at the same time save water are presented in the table.

The results of the research indicate that in order to obtain a high yield from the lemon plant, it is possible to use different irrigation methods on the condition that the soil moisture is maintained at 60-70%.

In this case, it is recommended to use the method of economical raining of water in order to get an abundant harvest from varieties of lemon plants with different growth potential. As such, this method is convenient, cheap, cost-effective and economical.

In private plots, it is better to water lemon trees with rain or sprinkler. The reason is that these methods are relatively convenient and effective.

When growing lemon plants in greenhouses, it is important to determine the effect of irrigation methods on their productivity, as well as the influence of irrigation standards, and the authors' opinions on this matter differ.

Lemon plants were studied through the effect of air temperature, humidity, watering frequency and their norms on the growth and development phases of the trees. It was observed that plant watering changes depending on the phases of biological change in them, growth dynamics and rest periods.

According to research results, lemon plant care requires a total of 25 waterings during the vegetation period. It was found that the water consumption in the drip irrigation method is 10,000 m³, in the drip irrigation method it is 3750 m³ and in the sprinkler irrigation method it requires an average of 58765 m³ of water.

In conclusion, it can be said that lemon plants have the characteristics of good growth and development in different irrigation methods. Irrigation of lemon groves grown on an industrial level in large areas with rain provides much better economic results. In this case, the amount of moisture in the soil is kept at the same level, and water consumption is reduced up to 50%, along with

obtaining an abundant harvest from each lemon tree.

Conclusion

When caring for lemon plants in greenhouses, it is necessary to take into account that they belong to the type of cool-loving and moisture-loving plants according to their morphological and biological structure. Then it will be possible to grow abundant and high-quality crops from them.

Taking into account the current ecological problems and water shortage, watering lemon plants in complex greenhouses using the modern sprinkler irrigation method will give good results. In this case, water consumption is two times less compared to furrow irrigation, and productivity is doubled.

It is recommended to water the lemon plant 25 times during the growing season in order to grow a plentiful and high-quality crop when the lemon plant is grown in a greenhouse in the climatic conditions of Uzbekistan. In this case, instead of 10,000m³ of water consumption using the sprinkler irrigation method, savings of up to 6,000m³ are achieved.

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