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### RESEARCH ARTICLE

#### SUSCEPTIBILITY OF STRAWBERRY CULTIVARS TO DROUGHT CONDITIONS

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#### Abstract

The article reveals the data on the drought tolerance of strawberry cultivars, studied the water content and water stress in the leaves of strawberry cultivars belonging to different ecological groups. Currently, water deficiency and the amount of water available for irrigation are a limiting factor in expanding the area under crops and increasing productivity. In the experiments, the air temperature, relative humidity, water content in the leaves and the effect of soil moisture on water scarcity and the correlation between them were studied by taking samples from the leaves of strawberry cultivars before and after irrigation of the experimental fields.

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#### Introduction:-

As a result of global climatic changes, various dangers in nature, droughts can occur. Modern science is emphasizing that if in the future there is a shortage in food and non-renewable natural resources, they can be replaced by products created in other ways, but nothing else can replace water. Therefore, the depletion of drinking water on our planet poses very serious risks. This is due to the contamination of drinking water mainly in groundwater, surface water of rivers and lakes with various chemical compounds [7, 8, 9].

Currently, water stress and water amount available for irrigation are a limiting factor in expanding the area under crops and increasing productivity.

Water stress has the most detrimental effect on many plants. Water stress, i.e. drought, primarily affects the water exchange processes of plants and is also manifested in other physiological processes of the plant (photosynthesis, respiration, assimilation of mineral elements through the roots, transport of substances in the body of the plants, etc.). As a result, plant growth and development slows or stops [3, 4, 6, 10].

In Uzbekistan, the cultivars non-resistant to heat and drought in summer and evening frosts in spring are more likely to be damaged and have a negative impact on crop quality [1, 2].

#### Materials and Method:-

Drought resistance of strawberry cultivars were determined by the method of E.A.Goncharova (1988) [3].

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Water stress (WS) and water content (WC) were checked at 6<sup>00</sup> in the morning and at noon at 14<sup>00</sup> when it was very hot, and in the evening at 18<sup>00</sup> when air relative humidity was lower. Water stress (%) in leaves was calculated on the basis of the following formulae:

$$WS = \frac{(AW \times 100)}{PW}$$

here: WS – water stress; AW- absorbed water content, difference between the weights of the leaf before and after water absorption; PW- present water, difference between the dry weight of the leaves and the weight after water absorption.

Leaf and shoot water content (%) was calculated based on the following formulae:

$$WC\% = \frac{(B_1 - B_2)}{B_1} \times 100$$

here: WC%- water content, B<sub>1</sub>- primary weight of leaves, B<sub>2</sub> – dry weight of leaves.

Fresh leaves of strawberry were taken for experiment from one year old strawberry grove.

All the data obtained from the results of the research were correlation analyzed by the method of B.A.Dospekhov based on Excel programme [5].

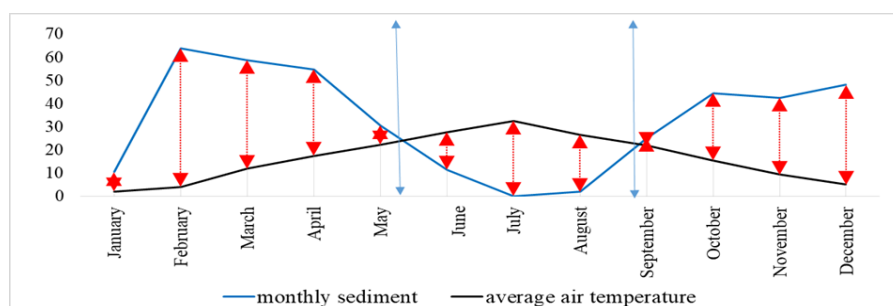
The degree of correlation was measured by its strength. Correlation was different on the strength of their impact: strong, moderate, weak. The magnitude of the correlation coefficient was positive from 0 to +1 in the direct correlation and negative from 0 to -1 in the inverse correlation. A correlation coefficient of 0 indicates that there is no correlation between the cases under study. Correlation is measured by the correlation coefficient. The degree of correlation of the study results was conditionally marked with colors. These are: weak-yellow, moderate -green, strong-red, and no-correlation -gray color.

**Table 1:-** Correlation coefficient.

Correlation value	Conditional color	Correlation coefficient	
		Positive correlation (+)	Negative correlation (-)
Weak	●	0-0,30	0- 0,30
Moderate	●	0,3-0,7	0,3-0,7
Strong	●	0,7-1	0,7-1
No correlation	●	0	0

## Result and Discussion:-

In order to determine the period of drought in 2017-2019, a climate diagram on the average rainfall and average air temperature was developed on the basis of 3-year hydrometeorological data. According to this diagram, precipitation fell to a minimum from January to June. While the average air temperature rose to its maximum from February to July. The lines marked by precipitation and average air temperature intersected in the 2<sup>nd</sup> decade of May. From the 3<sup>rd</sup> decade of August, the rainfall line began to rise again. Average temperature also began to decline from August. The lines marked by the amount of precipitation and the average air temperature intersected in the 3<sup>rd</sup> decade of August. It is obvious that in 2018, there was a period of drought from the 2<sup>nd</sup> decade of June to the 3<sup>rd</sup> decade of August (Fig. 1).



**Fig. 1:-** Phenological climate diagram of the experimental field(average in 2017-2019).

Data on air temperature and relative humidity observed during the growing season in the experimental field of strawberry varieties correspond to the average long-term parameters during the summer season. At the same time, the air temperature was higher during the day than the results obtained in the morning and evening and the relative humidity was found to be lower. The soil moisture of the experimental area of strawberry cultivars is given in Table 2, air temperature and relative humidity in Table 3.

**Table 2:-** Soil moisture of experimental field for the study of strawberry cultivars, % (average in the depth of 0-60 cm, average in 2017-2019).

№	Month	After irrigation	Before irrigation
1	June	18,5	14,5
2	July	18,2	13,5
3	August	19,2	13,6

**Table 3:-** Air temperature and relative humidity of experimental area for the study of strawberry cultivars (average in 2017-2019).

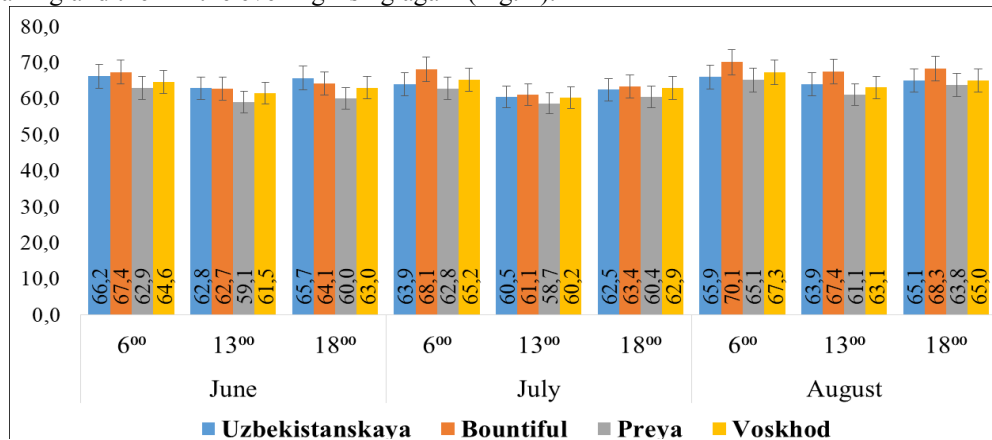
Month	After irrigation						Before irrigation					
	06 <sup>00</sup>		13 <sup>00</sup>		18 <sup>00</sup>		06 <sup>00</sup>		13 <sup>00</sup>		18 <sup>00</sup>	
	Temperature, °C	Relative humidity, %	Temperature, °C	Relative humidity, %	Temperature, °C	Relative humidity, %	Temperature, °C	Relative humidity, %	Temperature, °C	Relative humidity, %	Temperature, °C	Relative humidity, %
June	22,2	85,0	32,3	72,0	32,2	79,7	24,8	74,3	35,0	63,7	33,4	66,7
July	24,0	78,7	35,3	66,0	30,7	68,3	22,0	81,3	36,7	64,7	31,7	71,7
August	21,5	86,7	34,8	64,7	32,0	73,0	22,0	83,0	35,8	64,3	31,3	72,0

One of the most important indicators of the physiological process of the plant during the summer season is the amount of water.

It was found that the water content in the leaves of strawberry cultivars varies during the growing season and within cultivars, and does not have stable indicators.

It was also determined that the water content in the leaves of strawberry cultivars selected for the study varies during the growing season depending on soil moisture, air temperature and relative humidity, as well as the time of the day, and these indications vary among varieties.

Prior to irrigation in June month, that is, before watering the experimental fields, the water content in the leaves of strawberry cultivars was slightly higher in the cultivars Uzbekistanskaya and Bauntiful according to the observation results obtained at 6<sup>00</sup> in the morning, 13<sup>00</sup> in the afternoon and 18<sup>00</sup> in the evening. In July and August, high water content was maintained in Bauntiful cultivar. In particular, while the maximum amount of water in the leaves showed high levels in the morning, in the second half of the day at 13<sup>00</sup> the opposite was observed, falling and then in the evening rising again (Fig. 2).



**Fig.2:-** Water content in the leaves of strawberry cultivars (before irrigation), % (in 2017-2019).

After the irrigation of the field, it was found that the water content in the leaves of strawberry increased in the morning and went down in the afternoon at hottest time, and rose again in the evening during the day. Among the cultivars, the maximum water content was observed in Bautiful and Voskhod (Fig. 3).

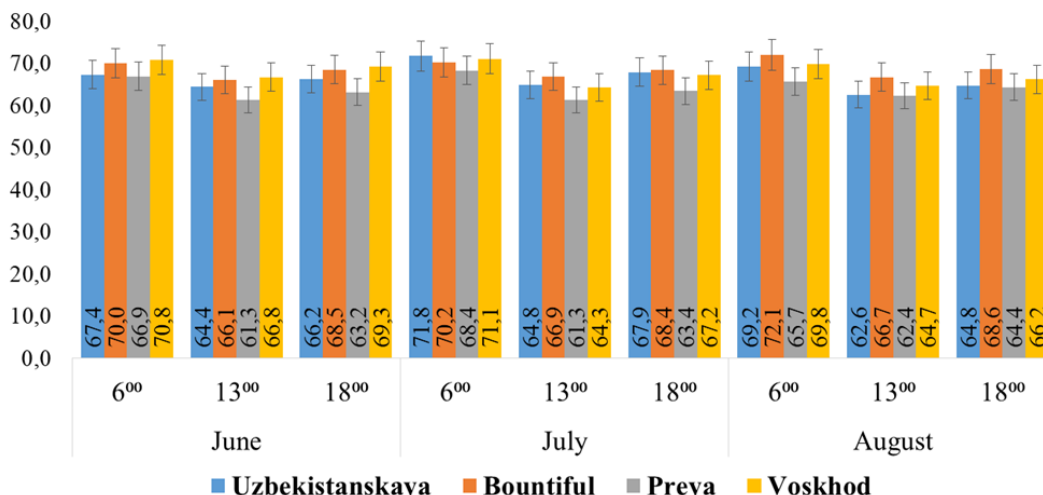


Fig. 3:- Water content in the leaves of strawberry cultivars (after irrigation), % (in 2017-2019).

The results of the study conducted prior to irrigation in the strawberry field showed that the water content in the leaves of all strawberry varieties before irrigation was lower than those indications obtained after the irrigation. It is a process of great importance to study the water demand of the leaves of strawberry cultivars and its change during the growing season depending on each cultivar.

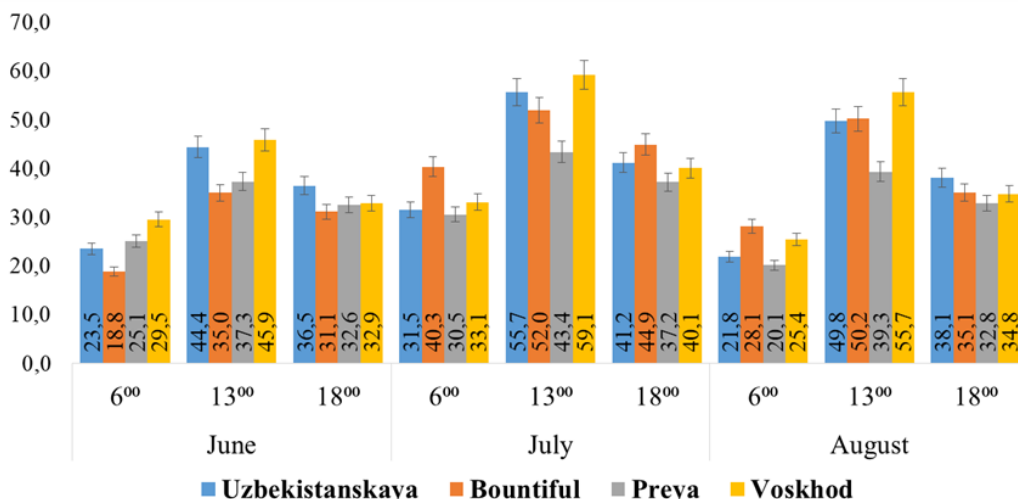


Fig. 4:- Water stress in the leaves of strawberry cultivars (prior irrigation), % (in 2017-2019).

According to the results of research obtained in July at 13<sup>00</sup> before field irrigation, the cultivars with the highest water stress in the leaves were Voskhod (59.1%) and Uzbekistanskaya (55.7%).

The least water-stressed in the leaves were Bautiful (18.8%) and Preya (20.1%) cultivars (Fig. 4).

The highest rate on water stress in the leaves after irrigation of the field was observed in Uzbekistanskaya (47.9%) variety in the daytime in July. The lowest water stress rate was observed in Bautiful (11.9%) cultivar in August (Fig. 5).

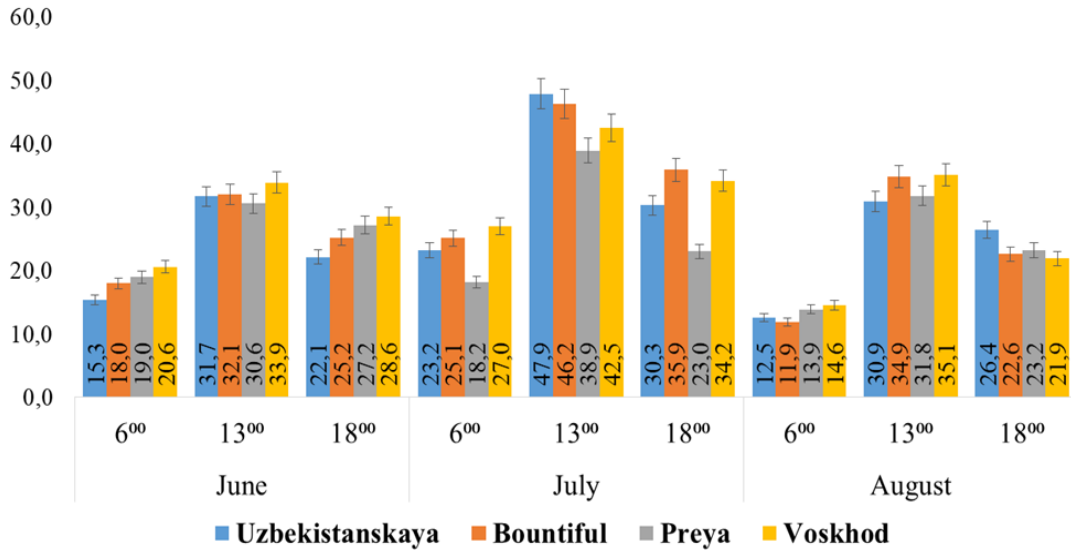


Fig. 5:- Water stress in the leaves of strawberry cultivars (after irrigation), % (in 2017-2019).

As a result of the analysis obtained from the above studies, the correlation dependence of air temperature, relative humidity, water content in the leaves and soil moisture on the water stress in strawberry cultivars was evaluated.

It was found that there is a positive correlation between air temperature and water stress in all cultivars of strawberries. The results obtained before irrigation showed that there was a moderate positive correlation (0.6) in the Bountiful cultivar, while in all other cultivars there was a strong positive correlation (between 0.8 and 0.9) both before and after irrigation. That is, the higher the temperature is, the greater the water stress.

The correlation between water stress and relative humidity in strawberry cultivars was found to be negative. In the prior-irrigation results it is shown that the Bountiful cultivar had moderate (-0.4) correlation, while in all other cultivars the correlations before and after irrigation were found to be strongly negative. That is, as the relative humidity increased, the water stress in the cultivars decreased inversely (Figures 6,7,8,9).

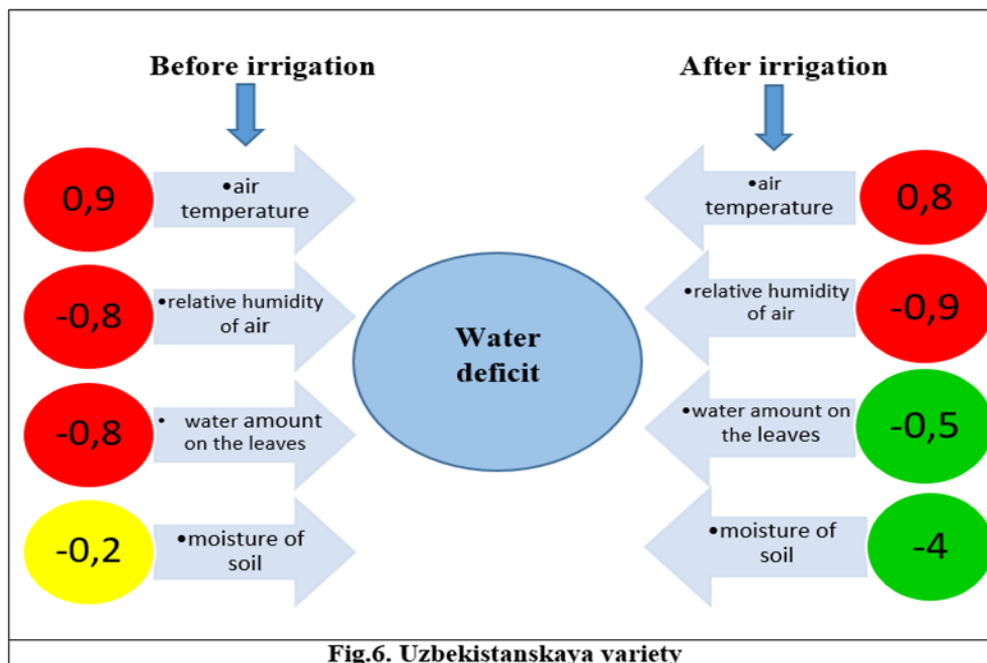


Fig.6. Uzbekistanskaya variety

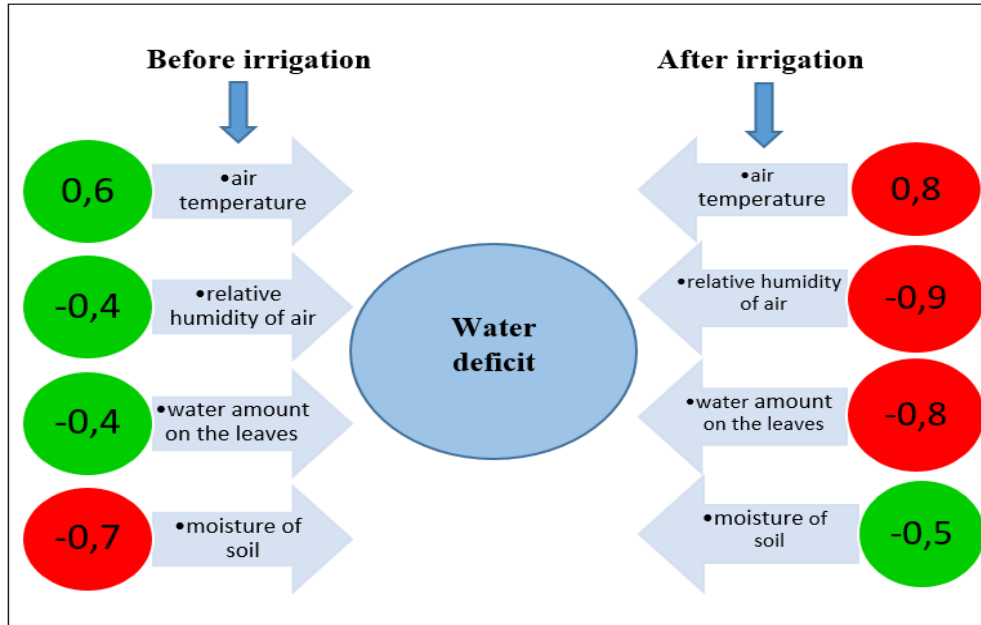


Fig.7. Bountiful variety

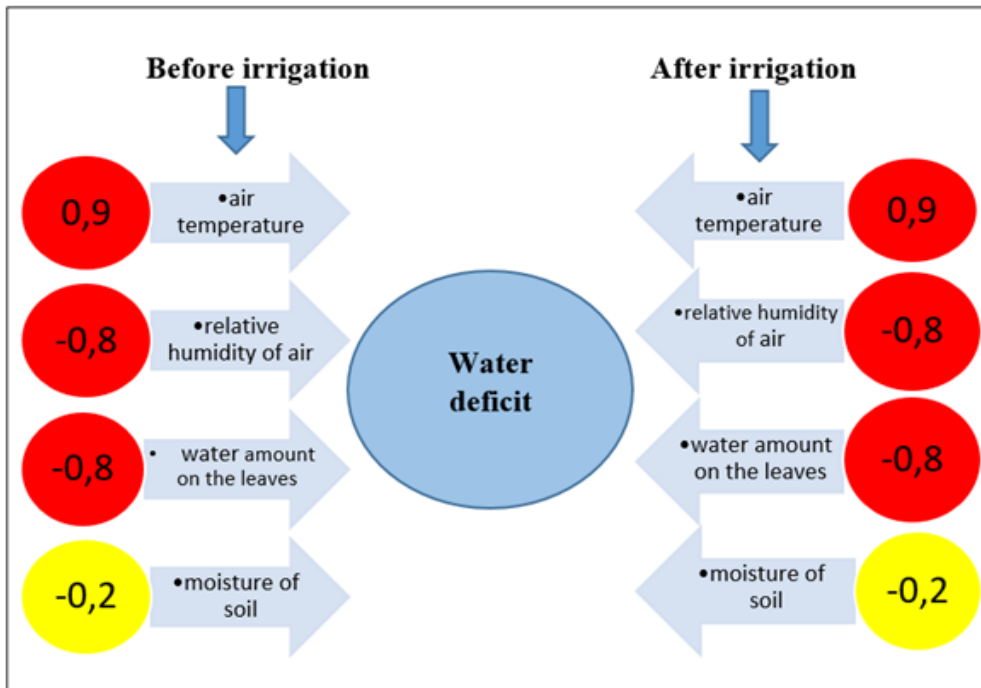
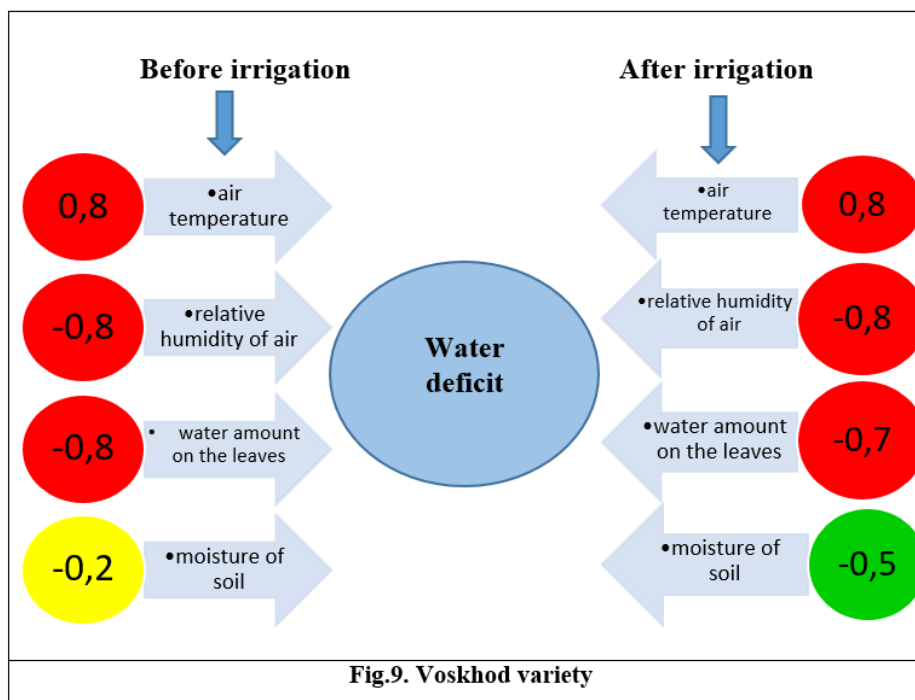


Fig.8. Preya variety



Figures 6,7,8,9:- Correlation dependence of water stress in the leaves of strawberry cultivars.

There is also an inverse correlation between water stress and water content in strawberry leaves. According to the results obtained before and after irrigation in the field, the negative correlations were at different levels in the cultivars, i.e., strong and moderate. This means that an increase or decrease in the amount of water in the leaves has a negative effect on water stress.

It was also determined that there was an inverse correlation between water deficit in strawberry leaves and soil moisture in the experimental field. In accordance with the results obtained before and after irrigation in the field, the negative correlations were at different levels in the cultivars. This means that an increase or decrease in soil moisture can cause an increase or decrease in water deficit in the leaves of the varieties.

### Conclusion:-

The following conclusions were drawn from the study of drought tolerance of strawberry cultivars:

1. During the summer months, as the air temperature increased, the amount of water in the leaves decreased and the water stress increased, and as the temperature decreased in August, water stress in the leaves decreased and the amount of water increased. In all cultivars, water deficit peaked in July and the amount of water in the leaves fell to a minimum level.
2. At 6<sup>00</sup> in the morning there is a lower water deficit due to lower air temperature and lower relative humidity, and at 13<sup>00</sup> in the afternoon there is an increase in water deficit due to higher air temperature and lower relative humidity, at 18<sup>00</sup> in the evening a decrease in water stress is observed due to a slight increase in relative humidity and decrease in air temperature.
3. An increase in air temperature, as well as a decrease in relative humidity, leads to an increase in water deficit in plants.
4. Decreased water content in the leaves of strawberry cultivars leads to an increase in water stress.
5. Decreased soil moisture in strawberry planted areas leads to increased water stress.

Among strawberry cultivars, the Bauntiful and Preya varieties were found to be the most drought tolerant compared to other varieties. These cultivars will be effectively used in selection-breeding in order to create future drought-resistant varieties.

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