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The Effect of Air Temperature and Relative Humidity to Winter Wheat Growth during Vegetation Period in Uzbekistan

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Abstract: The article analyzes the changes in the average air temperature and relative humidity during the growing season of winter wheat planted in different parts of the Republic of Uzbekistan, as well as the impact on plant growth during the sowing and harvesting phase. In autumn, the increase in relative humidity is polynomial, and the average temperature is reduced. The effect of air humidity on plant growth was determined between sowing- 3 leaf period, sprout-3-leaf period, 3-leaf period-gathering period in the Republic of Karakalpakistan, Samarkand and Fergana regions.

[Kholbaev G., Egamberdiev Kh., Kuziev J., Kazakbaeva A., Eshmirzaev D., Kholbaeva K., Babajanova G. **The Effect of Air Temperature and Relative Humidity to Winter Wheat Growth during Vegetation Period in Uzbekistan.** Nat Sci 2022; 20(4);47-55]. ISSN 1545-0740 (print); ISSN 2375-7167 (online). http://www.sciencepub.net/nature. 6. doi:10.7537/marsnsj200422.06.

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1. Introduction

It has been more than 25 years since the Republic of Uzbekistan joined the ranks of wheat-growing countries on irrigated areas. Wheat grown during this period fully met the per capita needs of the population. According to the State Statistics Committee, 7.6 million tons of grain were produced in the country during 2020. The influence of soil-climatic conditions and various environmental factors effect on the growth and development of wheat plants, the main of which are air temperature and relative humidity. These sizes limit the growth limits of the crop sown in the fall, which reduces the chances of maximizing yields during the growing season. In order to make effective use of these factors, we must first pay special attention to the timing of sowing, and then determine the impact of these factors on the plant and determine the optimal timing of sowing in each area. Wheat is usually sown in autumn or early spring. Then it was proved that the elements of wheat sown in autumn are higher than those sown in spring. This is one of the agro-technical measures, which allows to plan the sowing period and the possibility of accumulation in the basement during the transition to the dormant state of the plant.

According to sources, there is some information about the role of hydroponics and the development of relative humidity for various plants grown in greenhouses [https://dzagigrow.ru, https: // gidroponika]. While low relative humidity causes stress in plants, high humidity prevents it from cooling normally, i.e. slows evaporation [https://bookflowers.ru].

About the air temperature and relative humidity [Harold L. Weaver, 1990, Mohammad Reza Kousari & Mohammad Amin Asadi Zarch, 2011, Ellen Audia, and oth. 2021, Dana Magdalena Micu, and oth. 2021, Ellen Audia, and oth 2021] and its effect on agricultural crops [Kudoyarova G.R., and oth. 2007, Waldron L.J.& Terry N. 1987, Liu Yang, Xinrong and oth. 2011, Montes-García and oth. 2009] were studied. In Uzbekistan the researches about the changes of this measurements were conducted by Grupper S.R. 1998, Kholbaev G. Kh, Abdullaev A.K. 2020, Kholbaev G.Kh. and oth., 2020, Kholbaev G. Kh., Abdullaev A.K., Egamberdiev Kh.T. 2020,

Kholbaev G.Kh., Egamberdiev Kh. T. 2021, Aripdjanova F.A. and oth., 2021, Kholmatjanov B.M. and oth. 2021. However, the above-mentioned researches were carried out in a certain direction, and the results obtained in them, the scientific and practical conclusions obtained on the basis of their analysis were consistent with the scope of this research.

At present, the study of the effect of relative humidity in the conditions of winter wheat in Uzbekistan during the growing season and the elements of productivity is not fully disclosed. In this context, the study of the above-mentioned issues in irrigated areas is a topical issue and shows the need to study theoretical and practical tasks. This work will help to some extent in solving these tasks.

2. Research goals and objectives.

According to the data of the Uzhydromet archive for 1995-2020, changes in meteorological values (average air temperature (four, ° C), relative humidity, (f,%)) during the growing season of winter wheat in Uzbekistan and their height (h, cm) at different stages of development is to determine the effect.

The object

The object of study is meteorological quantities (average air temperature, relative humidity) in different regions of the Republic of Uzbekistan, winter wheat, and the **subject** is the change in average air temperature and relative humidity by seasons and plant height during the planting period.

Basic information.

In the study, data on average air temperature and relative humidity for 1995-2020, plant height were obtained from TM-1 and Agrometeorological diaries in the Uzhydromet archive fund. Data from stations located in different agro-climatic regions of the country (Nukus, Kattakurgan and Fergana) were used to determine changes in average air temperature and relative humidity.

Research methodology.

In the sources in the work [Ulanova E.S. et al. 1968, Abdullaev A.K. et al. 2009, WMO. 2017] and the methods used in them.

3. Results

The growing season of winter wheat in Uzbekistan is September-June. Therefore, we will first analyze the changes in average air temperature and relative humidity in September-June in regions with different geographical locations. As an example, in Figures 1-3 in the northern (Nukus), central (Kattakurgan) and Fergana valley (Fergana) regions of the Republic at different altitudes relative to sea level changes in relative humidity (f,%) and average air temperature (four) and air temperature 3 , The transition date from 3°C is given.

From September to December, the average change in air temperature is linear, and by regions it is as follows: in Nukus – 24,0 ° C, in Kattakurgan – 19,0 ° C, in Fergana - 20.0 ° C. The relative humidity value in Nukus was observed to increase from the first five days of September to the first five days of November, unless there was a significant change in the relative humidity value. In Kattakurgan, the change in the second decade of September is small and will increase sharply over the next five decades. The same situation was observed at the Fergana station. In Nukus, an increase of 31,0%, in Kattakurgan and Fergana to +30,0%, the temperature exceeded 3,0 ° C in the fourth five days of November in Nukus (Figure 1).

Even though the decrease of the average temperature was observed in Nukus and Kattakurgan in the third five days of January, in Fergana in the second five days, the relative humidity in maximum measures were observed in Nukus, Kattakurgan in the second five days of January, in Fergana in the third five days of December. The air temperature 3.0 ^{o}C was observed in Fergana in the fifth five days of December, in Kattakurgan in the fourth five days of December. (Fig.2)

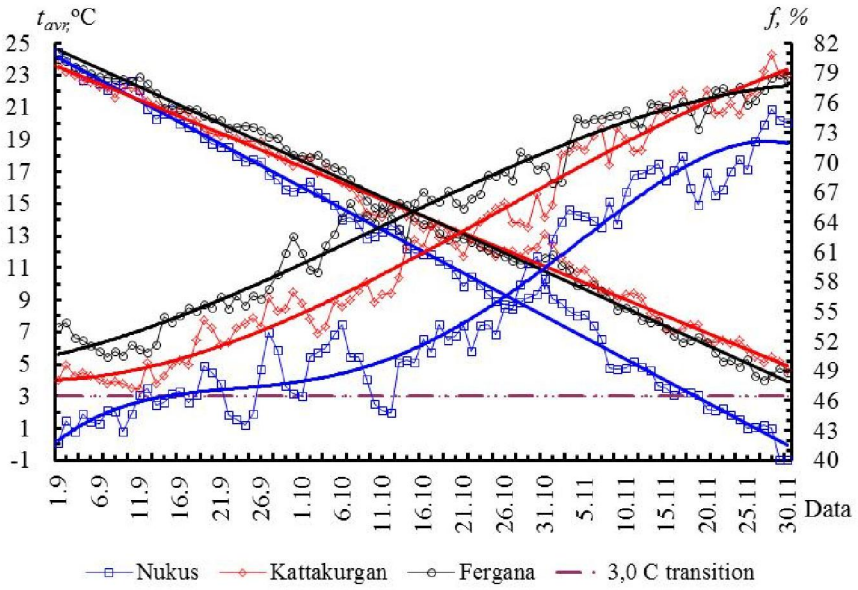

Figure 1. The changes in the relative humidity (*f,* %) and the average air temperature (t_{avr})in Nukus, Kattakurgan and Fergana station in IX-XI months, the air temperature 3.0 °C

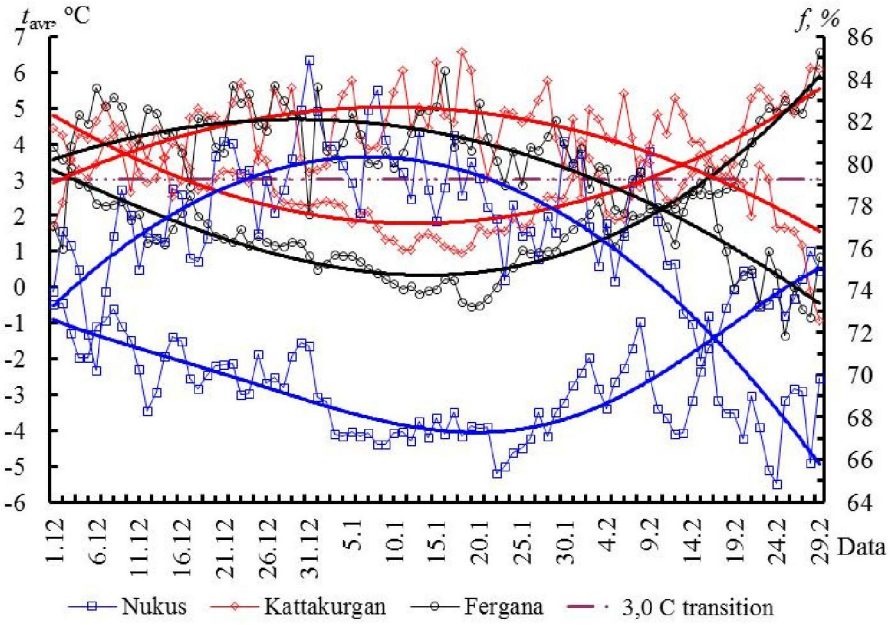

Figure 2. The changes in the relative humidity (*f,* %) and the average air temperature (t_{avr})in Nukus, Kattakurgan and Fergana station in XII-II months, the air temperature 3.0 °C

Figure 3 shows that there was observed a polynomial increase in average air temperature from March to June, a polynomial decrease in relative humidity. There is no significant change in Nukus in June. The air temperature 3.0° C in spring was observed in the first five days of March.

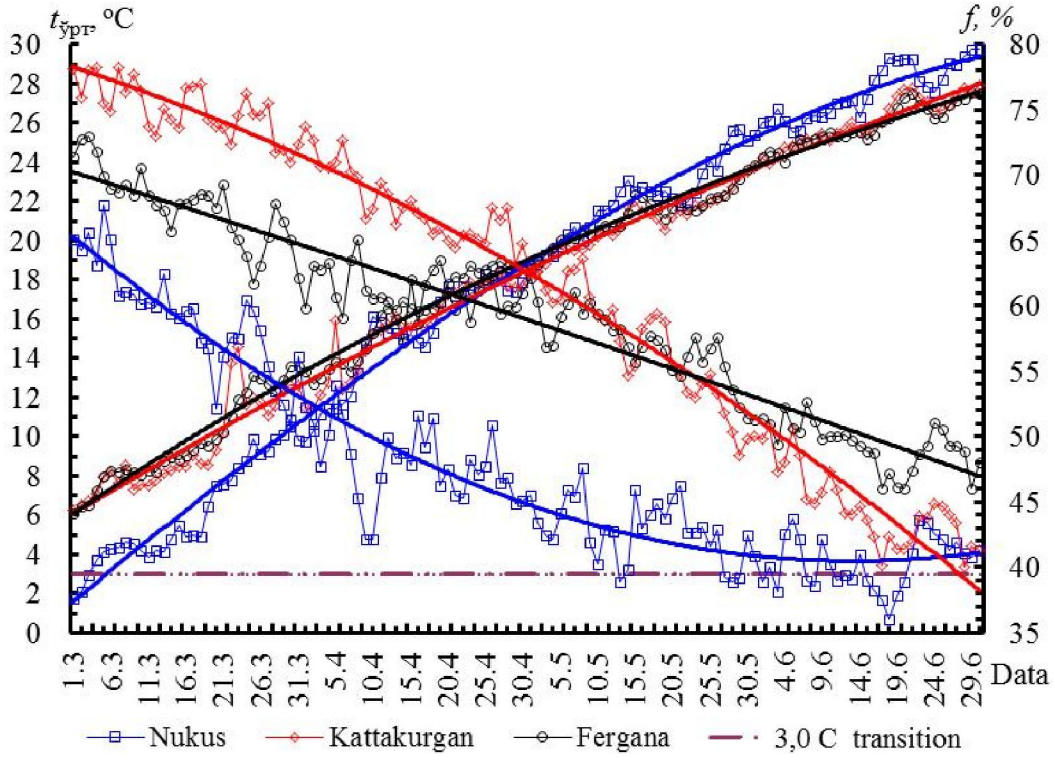

Figure 3. The changes in the relative humidity (*f,* %) and the average air temperature (t_{avr}) in Nukus, Kattakurgan and Fergana station in III-VI months, the air temperature 3.0 °C

In general, until the third five days of January, the average air temperature decreases, the relative humidity increases, and then the opposite trend is observed. In autumn, the temerature drops below 3.0 ° C at Samarkand and Fergana stations in December, in the northern region (Nukus) in November, and rises above 3.0 ° C in February in Samarkand region and Fergana valley, and in March in the northern region.

Equations for determining the relative humidity of the air in the autumn depending on the average air temperature and the amount of precipitation were developed (Table 1). Using the data in this table, it is possible to estimate the change in relative humidity in the period from the sowing of winter wheat to the end of the growing season.

Table 1. **Interconnection between the relative humidity of air (*f, %*) the average air temperature (t_{avr}, °C) and the rainfall (*R, mm*)**

Station	Regressive calculation	r	±Sy
Nukus	$f = -1{,}4050t - 0{,}2913R + 72{,}8483$	0,92	3,4
Kattakurgan	$f = -1{,}4164t + 0{,}2242R + 87{,}2478$	0,92	2,0
Fergana	$f = -1{,}4075t - 0{,}0374R + 84{,}9292$	0,93	1,6

In Uzbekistan, we consider the effect of relative humidity on plant height in the period from the date of sowing of winter wheat to the phase of accumulation (Figures 2-4).

As can be seen from Figure 2, at Kattakurgan station, the value of average relative humidity in the period from seedling phase to 3rd leaf phase is in the range of 68-80%, and in the range from 64-78% of average relative humidity in the period from planting to 3rd leaf.

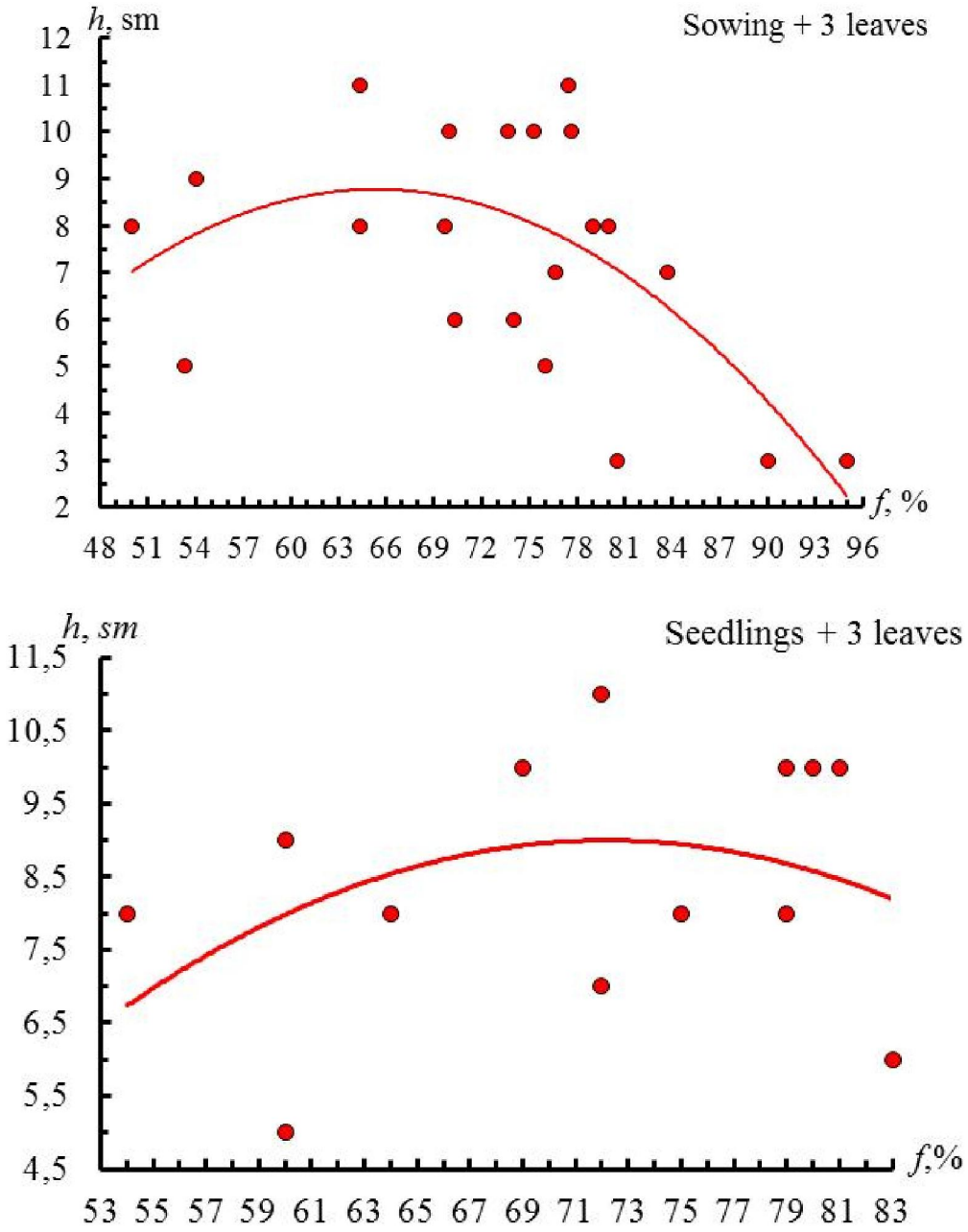

Figure 2. The effect of the relative humidity of air (f, %) on the plant growth (*h*, sm) from sowing+3leaf phase to sprout+3 leaf phase in Kattakurgan

Figure 3 shows the effect of average air relative humidity on plants during the period from germination phase to 3 leaf and accumulation phase at Fergana station.

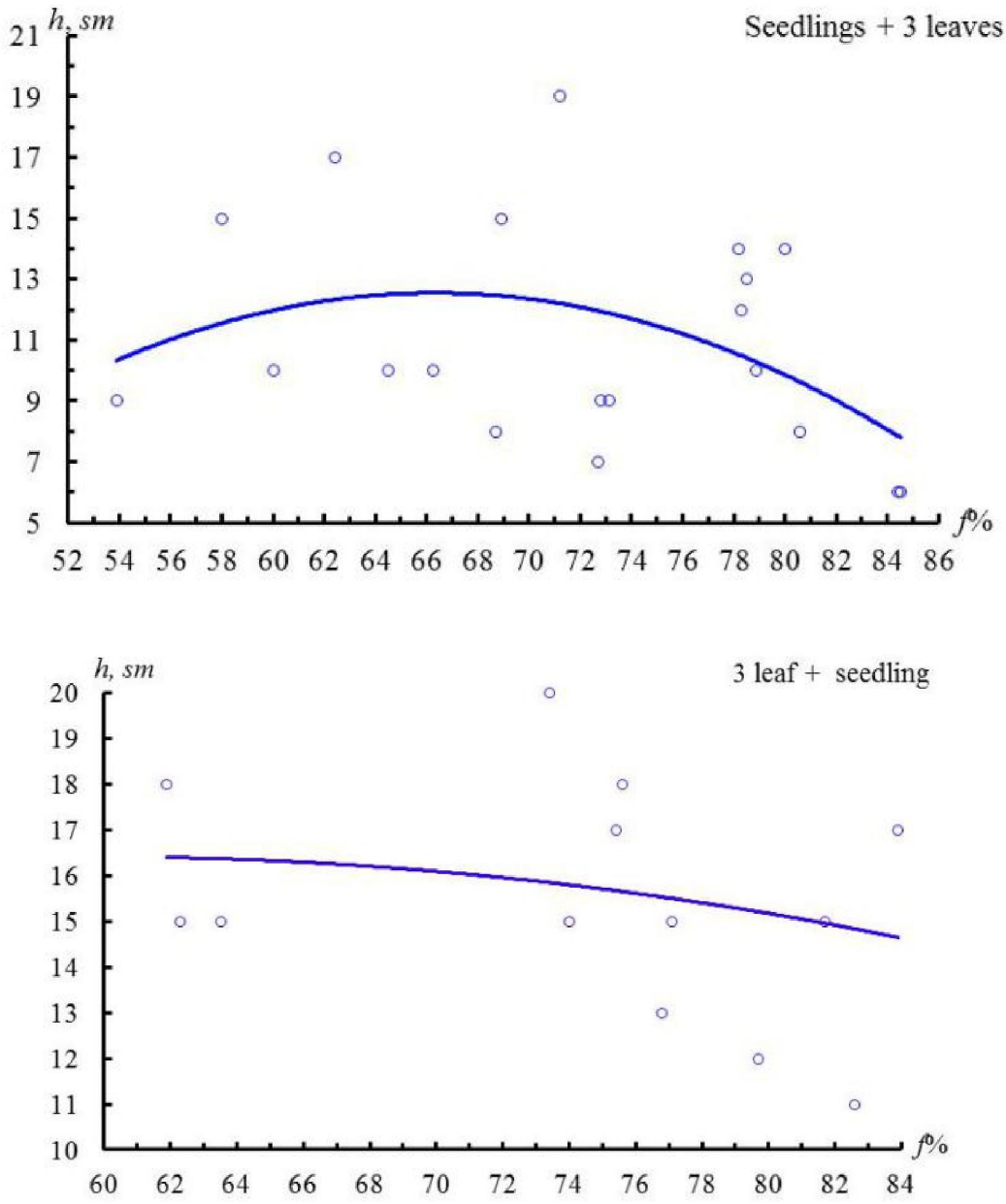

Figure 3. The effect of the relative humidity of air (f, %) on the plant growth (h, sm) from sowing+3leaf phase to seedling+3leaf phase in Fergana

At the Fergana station, the average relative humidity in the period from the germination phase to the 3rd leaf phase is 62-75%, and in the 3-leaf accumulation phase it has maximum values in the range of 65-75% (Fig. 3). At the Nukus station, the average relative humidity in the period from the 3rd leaf phase to the accumulation phase was 46-58%, and in the period from sowing to the accumulation phase, the average relative humidity was 34-42% of the maximum plant height (Figure 4).

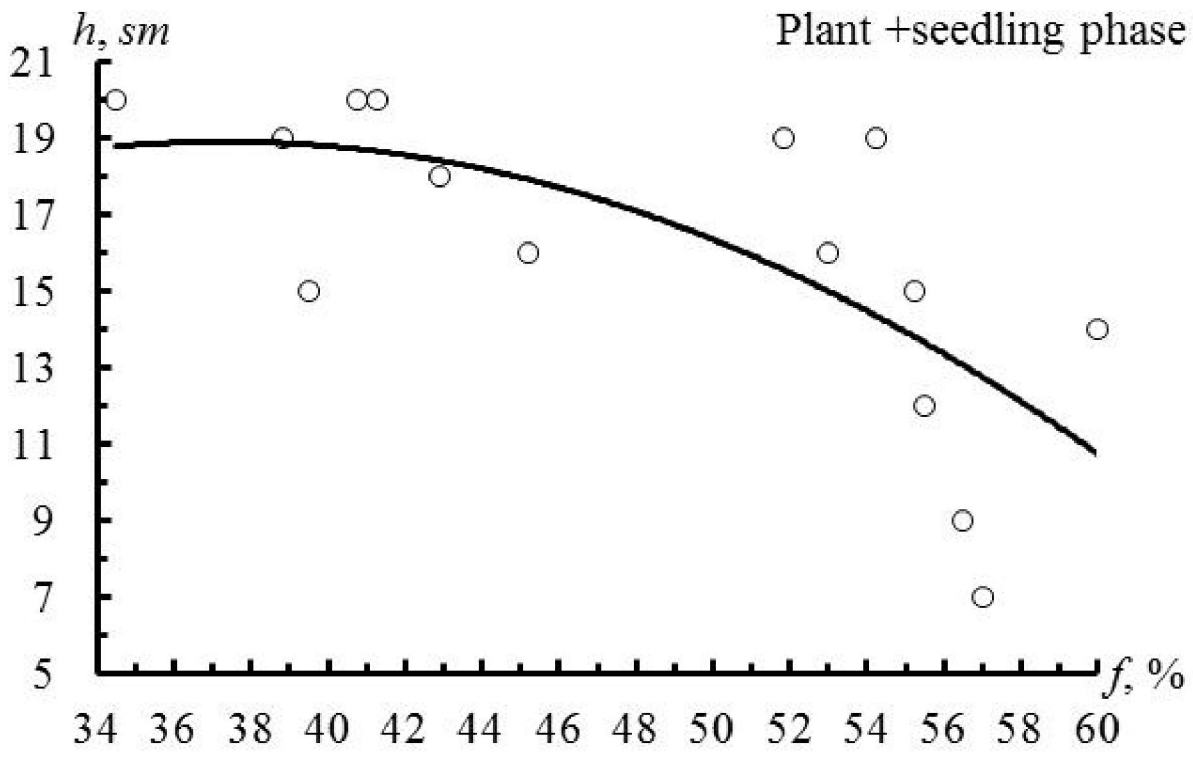

Figure 4. The effect of the relative humidity of air (f, %) on the plant growth (*h*, sm) from sowing to seedling phase in Nukus

4. Conclusion

The increase in relative humidity in autumn is polynomial in nature, while the decrease in average air temperature is linear in nature. The change in relative humidity over months is the opposite of temperature. In the Republic of Karakalpakstan, the end of vegetation occurs in the third decade of November, in Samarkand region and Fergana region in the first five days of December.

Equations for determining the relative humidity of the air in the autumn depending on the average air temperature and the amount of precipitation were found. Using these data, it is possible to estimate the change in average relative humidity in the period from sowing of winter wheat to the end of the growing season.

The value of relative humidity in the period from seedling phase to 3-leaf phase at Kattakurgan station is in the range of 68-80%, relative humidity in the period from sowing to 3rd leaf is 62-89%, relative humidity in the period from seedling phase to 3-leaf phase is 62-72 %, 60-65% in the 3-leaf accumulation phase and 46-58% in the Nukus station from the 3-leaf accumulation phase to the accumulation phase, and 34-42% relative humidity in the period from planting to the accumulation phase.

These data allow us to assess the condition of the plant in the autumn.

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