American Journal of Biodiversity
https://biojournals.us/index.php/AJB
ISSN: 2997-3600

Methods and Devices for Drying Agricultural Products

Sarimsaqova Shahodat
Independent researcher, Andijan Institute of Agriculture and Agrotechnologies

Received: 2024, 15, Jan
Accepted: 2025, 21, Feb
Published: 2025, 20, Mar

Annotation: This article discusses the drying of fruits and vegetables under natural conditions in order to effectively use agricultural products. To create a device for drying fruits, vegetables and dairy products in natural conditions, he succeeded in drying melons and apples and made a simple device for this. The experiments were carried out over six days. Changes in their mass were recorded daily in three places, and tables and relationships were presented graphically. Also, the theoretical foundations are presented analytically in the form of equations and are completed with a brief summary and a list of references.

Keywords: Natural, climate, temperature, organoleptics, apple, melon, illumination, atmospheric air pressure, analytical.

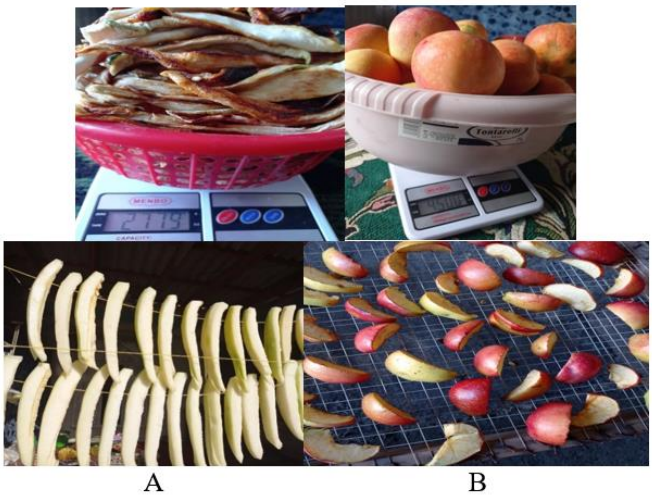
As is known, the demand for agricultural products, such as fruits, vegetables and legumes, which are grown in large quantities in our republic, is increasing day by day. The qualitative harvesting of agricultural products and their delivery to consumers is one of the priority directions of state policy. Harvesting agricultural products during their ripening period is one of the main processes. The timely harvesting of ripe fruits and vegetables in agriculture depends on many factors. These main factors depend on the mechanization and automation of work processes. It is no secret that currently, many work processes in the cultivation of fruits, vegetables and melon crops in the agriculture of our republic are carried out manually.

After all the fruits, vegetables and melons grown in agriculture are fully harvested, they can be divided into several groups. Those that are of good quality and look good are sorted into high,

medium and not very good quality. This is called organoleptics in science. The good quality and selected group is prepared for export as much as possible. Those that are divided into the second group are sold to local markets. It is advisable to process the agricultural products divided into the third group in order to use them as productively as possible. That is, drying, pickling, salting, etc. Those divided into the second group are not suitable for transportation over long distances. It is advisable to use various methods to use agricultural products that are grown in excess of consumption. Such methods allow for the full use of agricultural products by natural or artificial drying of fruits, vegetables, and melons. This, in turn, partially limits the waste of agricultural products.

A number of works on the preservation and primary processing of agricultural products appeared in Central Asia in the 9th-12th centuries. Among them are Ibn Al-Haytham (965-1035), Ibn Khatib al-Razi (1149-1209), Ibn Rashta (12th century), Ibn Hammar (born in 945). Muhammad ibn Bahram (Abu Hamid ibn Ali Umar, died in 1194, Hasrat Mashhadi Sayyid Muhammad, 17th century) and others who wrote in their works about the need to consume agricultural products in winter and summer and about their benefits. Modern conditions allow for the storage and processing of any agricultural products [2].

We tried to conduct several simple elementary experiments in order to study the drying methods and drying of dried fruits, vegetables and melon products in natural conditions [3]. For this purpose, we prepared a wooden frame 2 meters long and 1.5 meters wide and stretched a layer of linseed material with a gap of 8-10 mm between it. The purpose of this was to raise the dried fruits, vegetables and other melon products several levels above the ground so that they could be well ventilated from above and below (Picture. 1).



A B

Picture 1 A, B, Photo plates from the process of drying melons and apples in natural conditions.

Melons and golden apple varieties were selected for the experiment and their conditions in the sun and in the shade were monitored under a daily change table. The atmospheric temperature was recorded at 3 points every day at a certain time, and the results are presented in the following tables (tables 1, 2.).

Results of observing the changes in the mass of fruits and vegetables during drying in the open air under natural conditions (melon-torpedo variety)

Table 1.

№	Days	Initial mass, gr.	The temperature of atmospheric air in the sun, ^{0}C			The temperature of atmospheric air in the shade, ^{0}C		
			morning 8^{00}	afternoon 13^{00}	Evening 16^{00}	morning 8^{00}	afternoon 13^{00}	Evening 16^{00}
1.	**21.09.2023**	**5000**	**20**	**30**	**18**	**18**	**27**	**17**
2.	**22.09.2023**	**4500**	**20**	**32**	**17**	**18**	**29**	**17**
3.	**23.09.2023**	**3700**	**19**	**30**	**18**	**12**	**17**	**16**
4.	**24.09.2023**	**3150**	**15**	**17**	**14**	**15**	**15**	**14**
5.	**25..09.2023**	**2210**	**17**	**25**	**20**	**16**	**22**	**18**
6.	**26.09.2023**	**1700**	**13**	**31**	**17**	**12**	**28**	**16**
7.	27.09.2023	750	12	33	17	13	29	13
Average temperature			16	28	17,2	14,3	23,3	15,7

Results of observation of changes in the mass of fruits and vegetables during drying in the open air under natural conditions (apple-golden variety)

№	Days	Initial mass, gr.	The temperature of atmospheric air in the sun, ^{0}C			The temperature of atmospheric air in the shade, ^{0}C		
1	**21.09.2023**	4500	20	32	17	18	29	17
2	**22.09.2023**	4000	19	30	18	12	17	16
3	**23.09.2023**	3400	15	17	14	15	15	14
4	**24.09.2023**	2330	17	25	20	16	22	18
5	**25..09.2023**	1750	13	31	17	12	28	16
6	**26.09.2023**	1335	12	33	17	13	29	13
Average temperature			16	28	17,2	14,3	23,3	15,7

Artificial drying is carried out by convective, conductive, contact, radiative and mixed methods, depending on the method of heat transfer. The most widespread of these is ventilation using an active air stream[1]. The essence of the convective cooling method is that it uses the difference in partial vapor pressures between the temperatures of the drying substance (agent) and the materials being dried, which are formed between a hot air stream or a mixture of air and gas. The greater the difference in partial pressures, the higher the result (efficiency). In this method, the drying agent, passing through the layers of the material being dried, heats it and absorbs the evaporated moisture. The directions of such air flows are divided into three types. The first is that if the direction of the flow of the drying agent is in one direction, then this type is called direct-flow, if the movement of the material being dried is against the flow of the drying agent, then this drying method is called counter-flow. This method is used to dry materials at high temperatures.

The peoples of Central Asia, including Uzbekistan, have learned to dry excess fruit, vegetable and melon crops in order to effectively use them. However, little attention has been paid to the drying devices and drying regime parameters for each type of fruit and vegetable, while maintaining their high nutritional value. Also, the main parameters of the technological processes and influencing factors in the artificial and natural drying of most fruit, vegetable and melon products grown in Uzbekistan have not been analyzed in detail.

The drying process of fruits, vegetables and melons is understood as the removal of liquid at any stage of their formation. As a result, the moisture contained in many agricultural products is released into the surrounding atmosphere in the form of vapor.

Theoretically, the balance equation of a drying device can be expressed as follows. The

agricultural product supplied for drying consists of two components, namely the initial and the mass difference after drying.

The balance of a drying device is determined by the amount of evaporation from the device through the parameters of the air entering and leaving the device.

The mass of dry air entering the drying device, M_x,, d_1 is the amount of moisture in it. When removing the amount of moist air from the material, its value increases to d_2, while the mass of dry air remains unchanged. Based on this idea, the following equation can be written.

Balance equation of the dryer.

The composition of the product placed in the dryer consists of two parts, the first is the mass of moisture in the dried part M_1 and the second is the remaining mass of the product after drying M_2 is the sum of both

$$\Sigma M = M_1 + M_2 \quad (1)$$

As the amount of moisture in the product being dried increases, the moisture in it evaporates. It is observed that the initial moisture content of the substance H_1 decreases to H_2 in it. The amount of moisture evaporated in it

$W = H_1 - H_2$ will be equal to. (2)

If the mass of material placed in the dryer for one hour, the amount of moisture in it will be equal to the following.

$$H_1 = \frac{\Sigma M \Omega 1}{100}{}_1; \quad (3)$$

If we take into account the moisture removed from the dryer, then H_2 is equal to:

$$H_2 = \frac{\Sigma M \Omega 2}{100}; \quad (4)$$

Ω_1, Ω_2- The relative humidity of the initial and post-drying masses of the material being dried is determined by the following equations and is expressed in percentages.

$$\Omega_1 = \frac{100H1}{M1+H1} \text{ and } \Omega_2 = \frac{100H2}{M2+H2} \quad (5)$$

The amount of moisture evaporated in the device (kg/h) is found by substituting equations (3) and (4) into equation (2).

$$H = \frac{\Sigma M \Omega 1 - \Sigma_M \Omega 2}{100} \quad (6)$$

The mass of the dry matter does not change during drying, then the equation looks like this.

$$M_1 = \frac{\Sigma M(100-\Omega 1)}{100} = \frac{M2(100-\Omega 2)}{100} \text{ based on this equation}$$

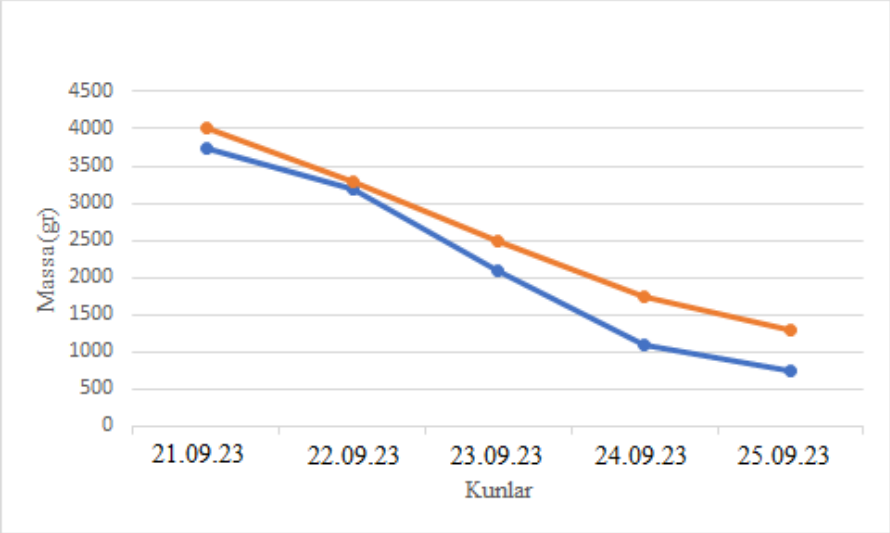
$$\frac{\Sigma M}{M2} = \frac{100-\Omega 2}{100-\Omega 1} \quad (7)$$

ΣM and M_2 Substituting the values of , equation (6) becomes:

$$H = \Sigma M \frac{\Omega 1-\Omega 2}{100-\Omega 2} = M_2 \frac{\Omega 1-\Omega 2}{100-\Omega 1}; \quad (8)$$

Based on the above equations and experiments conducted under natural conditions, a drying device can be established. In addition, it is desirable to study the effect of illumination and atmospheric air pressure on drying.

Based on the experiments carried out in natural conditions, i.e., the change in mass of melons and apples during drying in daily weather conditions, i.e. how much moisture is absorbed during the day, can be seen in the graph below, Picture. 2.



Picture 2. Connection diagram of the process of drying melons and apples under natural conditions

The following conclusions can be drawn from the work done above.

1. Timely and effective use of fruits, vegetables and pulse crops grown in agriculture is one of the urgent issues of today.
2. Modern drying devices and parameters of technological processes based on the natural drying method for effective use of fruit, vegetable and fruit products surplus to export and consumption is a requirement of the period.
3. It is desirable to study the structure, operation and effectiveness of existing devices for drying fruit, vegetable and vegetable crops.
4. Experiments have shown that after 6 days of drying in the open air under natural conditions, 15% of the initial mass of melons and 29.6% of apples remains in the graph.
5. One of the main issues of the present day is to base the results of experiments conducted in natural climatic conditions on the results of the experiments and to establish automatic control of temperature, pressure, illumination and other similar parameters in them.
6. Mathematical expressions are given to compare the results of the experiments with analytical calculations, that is, with their theoretical bases, and to determine their adequacy.

References

1. V.P. Zuev, V.S. Shkrabak Application of heat in agriculture, Leningrad, “Kolos” 1976, 232 p.
2. Z.Turgunov Fundamentals of mechanization of initial processing and storage educational methodical complex 3 years for the specialty of KHM 2016.
3. E.P. Shirokov. Technology hranenia i pererabotki plodov i ovoshey. M.: Colossus. 1994g.