

# Agrobiological and Technological Peculiarities of Juicy Pumpkin Varieties

Shavkat Ergashevich Umidov

Independent Researcher, Senior Lecturer of the department of Storage and reprocessing of agricultural products, Tashkent State Agrarian University, Tashkent, Uzbekistan

**Abstract:** This article outlines the data about the investigations conducted on pumpkin cultivation and selection of its juice suitable varieties. Hereby, highlighted the general conceptions about pumpkin types and varieties. Moreover, the investigations were carried out on 10 varieties belong to 3 types of pumpkin and 4 out of these varieties were recorded in state registry. Juicy pumpkin varieties were studied during the research and it was also recommended to work out technological scheme for production.

**Keywords:** pumpkin, productivity, germinability, biochemical content, juice, pasteurization, homogenize, organoleptic indicators, technological scheme.

## 1. Introduction

Pumpkin is one of melon crops with high production due to its wide consumption and curative properties. The carbohydrate, protein and fat in the content of pumpkin serve as an additional source of nutrients for the human body.

Pumpkin contains more than 50 kinds of biologically active substances necessary for human. It is also rich in vitamins such as mineral salts, carbohydrate, various fats, ascorbic acid, retinol, thiamine, riboflavin, nicotinic acid and so on [2].

Pumpkin plants are called as health guards. If the human body lacks in vitamin C, the scorbatus and anemia appear, deficiency of Vitamin A slows down the growth of body and causes eyesight worsening, vitamin B<sub>1</sub> deficiency causes the development of various diseases and B<sub>2</sub> includes to the group of enzymes involved in protein and fat metabolism. In order to provide our body with these vitamins, A, B<sub>1</sub> and B<sub>2</sub> are to be consumed by 2-3,5 mg, vitamin C by 50-120 mg and PP by 15-25 mg per day [3].

Melon crops are cultivated total in 6,2 mln hectares of tropical, subtropical and moderate climatic zones in the world and obtained 142,4 mln tons of gross yield annually. The leading melon crop producing countries are – China, Turkey, India, the USA, Iran, Egypt and Spain. In Uzbekistan this crop has been cultivated since the ancient times due to its favorable soil-climatic condition. Especially, melon fruit has been considered the most important and favourite product of Central Asian people since the past times because of high nutritive content and delicious taste of fruit [2, 3, 4].

Our republic is one of the largest centers for growing melon crops in the world. In our country melons and musk pumpkins are cultivated which are distinguished by their sweetness and other qualities. However, the demands for them haven't been met fully yet. In our country the fruits of pumpkin are used only for direct consumption. The processing of pumpkin fruit in the form of various canned

products is one of our prior tasks [1].

The pumpkin belongs to *Cucurbita* L. genus of *Cucurbitaceae* Juss. family. Having undergone a far evolution progress *Cucurbita* pumpkin genus includes 21 species. Out of these species only 5 are cultural species. There are 3 types of pumpkins grown in our country: hard-rind or simple pumpkin, large-fruited pumpkin and musk pumpkin. Each of these species is extremely diverse in terms of morphological and farm-valuable biological traits. In this regard, they are grouped into subspecies, and the subspecies are further divided into variations or types. There exist wild-growing subspecies too among the large-fruited pumpkin and hard-rind pumpkin types [6, 7].

Melon culture is one of ancient aspects of agriculture in Uzbekistan. According to historical data, melon crops were grown here in the 4th century of BC. There are many varieties of pumpkin in the Republic of Uzbekistan. According to the Uzbekistan Scientific Research Institute of Plant Science, there are 141 varieties related to 3 cultural types of pumpkin, including 57 varieties of musk pumpkin, 45 varieties of large-fruited pumpkin and 38 varieties of hard-rind pumpkin. These varieties are cultivated mostly in Zarafshan, Kuyi Amudarya and Fergana valley. Moreover, musk pumpkin is widely grown in Fergana valley, while large-fruited pumpkin types are mainly cultivated in Zarafshan and Kuyi Amudarya valleys. In Surkhandarya and Kashkadarya regions, that is in the southern parts of the country, pumpkin varieties are much less, total 5 musk pumpkin varieties are grown [8,9].

The amount of regionized pumpkin varieties totally constitutes four in the republic: musk pumpkin (Kashkar 1644 and Palov kadi 268), large-fruited pumpkin (Ispan 73), hard-rind pumpkin (Non kadi). Out of these, Ispan variety is late-maturing, the rest are mid-season types [16].

Pumpkin crops require special soil conditions. They grow well and produce high yield in the soils with light mechanical content, rich in organic matters and mineral nutrients and also balanced water –air regime [15].

**Table 1:** Pumpkin varieties grown in Uzbekistan

Types	Varieties	Growth period, days	Productivity, c/ha	Resistance to wilt	Validity for long transportation	Storage quality	Sugar amount, %	Fruit		
								A mean mass, kg	Shape	Rind color
Large-fruited pumpkin	Ispan 73	130-140	200-290	–	valid	best	8,0-14,0	4-5	Round flattened	Greyish green
Musk pumpkin	Palov kadi 268	110-120	350-450	–	medium valid	good	5,0-5,4	5-6	Elongated round	Straw-colored
	Kashkar 1644	100-120	400-450	–	valid	good	5,0-5,6	5-20	Elongated	Orange
Hard-rind pumpkin	Mozo-leyevskaya 10	80-100	350-400	non-resistant	valid	good	5,0-5,4	4-6	Egg-shaped	Yellow with green stripes
	Shirintoy	135	270	resistant	valid	good	5,0-5,5	2,5	Elongated	Dark yellow

The determination of the most proper sowing time which provides complete germination, growth and development of melon crops, is considered an important part of the technology of crop production, furthermore, it ensures high yield with particular biological peculiarities and farm-valuable traits [9, 10].

Sowing time mostly depends on soil temperature, because melon crops are very sensitive to soil temperature. Unless the soil of 8-10 cm depth is warm enough up to 8-10°C degrees it is not recommended to plant large-fruited and hard-rind pumpkin types. Certain times of plant sowing depend on climatic and soil conditions of the area, the duration of vegetation period of the crop variety, and for what purpose the yield is used and other factors [10].

Melon crops are mainly consumed in their season – summer and autumn months in Uzbekistan. In winter and spring they become deficient product. Therefore, the cultivation of late-maturing, transportable varieties with storage quality and their proper storage methods allow availability of these melon products for consumption throughout the year.

Storageable pumpkin varieties are very hard and heavy, but not so large. At the beginning of shelf life it contains much starch substance, after 2-3 months the starch turns into soluble sugar and consequently, the taste and nutritional value of pumpkin increase.

When the pumpkin mature it becomes hard, turns its color and fruit base dries. For storage the mellow fruits are selected that are not damaged and not infected with diseases and pests. The pumpkin which is intended to be stored for a long period, is to be left under the sun for 5-7 days.

Pumpkin contains a lot of water and while the storage life much loss of water causes to quality decreasing. Pumpkins are stored in shelves laying blanket under them, flat varieties are placed on shelves remaining fruit base upwards. Air temperature in stores should be around 1-14°C degree and relative humidity about 70%. Cold and humid facilities are not recommended for pumpkin storage [11, 12].

**The aim of the research and certain issues.** Scientific investigations were carried out in 0,10 ha field of experimental plot in TSAU in Tashkent region during the years 2015-2018. Experiments were performed on 10 varieties of pumpkin. The aim of the research is to select pumpkin varieties for juice, to study their chemical content, and to develop juice extracting technology. Actually the technological procedures were investigated and scientifically

proven. In dissertation work a definite solution for these issues has been developed and proven.

## 2. Methods of research

The investigations were conducted on the following varieties of pumpkin: Cucurbita maxima - Ispan 73, Cucurbita Pepo – Non kadi, Cucurbita moschata – Palov kadi, Gapvu tradiny (Korea), Kichkintoy, Korean Pumpkin, Kormovoy, Mamordika, Kashkar 1644, Ispankaya gitara.

The followings have been studied in the field according to chosen theme:

- 1) Cultivating agro-techniques of pumpkin plant;
- 2) Productivity and growth features of pumpkin;
- 3) Juice level and juice content of pumpkin fruit;
- 4) Technology of extracting pumpkin juice.

The methods for performing research are as follows:

- 1) Phenological observations (dates were fixed by phenology). Germination of pumpkin, formation of preliminary leaves, width of plant stem, growth period, flowering, fruiting, number of fruits and maturation have been noted.
- 2) Determined the beginning time of germination
- 3) Identified the number of fruits (20 pcs) in pumpkin stems in the term of plant variety.
- 4) Measured total length of stem and its growth dynamics (each 15 days).
- 5) Calculated total number of pumpkins, weight and the mass during the growth period (on 20 plants).
- 6) Soil of the pumpkin planted field, nitrogen, phosphorus, potassium and moisture amount in the content of the plant were determined by general agro-chemical and agro-physical methods of soil.
- 7) Studied chemical content of fruits, juice productivity and quality.
- 8) Conclusions were presented on increasing juice amount in juice production.
- 9) The measures were developed on the improvement of organoleptic features of juice.

Phenological observations, biometrical measurements, surveys and calculations were carried out in the experiments on main and additional stalk length, flowering and fruiting phases, and also determination of productivity per area unit. Moreover, technological processes of pumpkin juice extraction were scientifically analyzed. Statistical analysis of experiment results was performed by dispersion method according to Microsoft Excel program.

The following methodological materials were used to conduct experiments: Methods for state grade-testing of agricultural crops: - edit. IV. Potato, vegetable and melon culture, "Methods of field experiments", "Methods of experimental work in vegetable-growing and melon production", "Methods for conducting experiments in vegetable-growing, melon production and potato-growing", OST, 46 71-78: "Plots and scheme of sowing in breeding, quality-testing of primary seed-breeding of vegetable crops. Parameters".

### 3. Results and Discussion

In order to conduct an experiment 10 widespread pumpkin varieties: Cucurbita maxima - Ispan 73, Cucurbita Pepo – Non kadi, Cucurbita moschata – Palov kadi, Gapvu tradiny (Korea), Kichkintoy, Korean Pumpkin, Voljskaya Seraya, Mamordika, Kashkar 1644, Ispanskaya gitara were selected and sown on May 10. The seeds before sowing were remained in water for a day, then they were sown in experimental plot of TSAU under control variant and in 3 repetitions. Inter-row distance made 250 cm, the distance between the nests constituted 50 cm, the seeds were sown in each nest by two pieces. Germinability of pumpkin was

observed during 7-15 days.

Among the varieties an average germinability indication was 95 % in Ispan 73 variety, for Non kadi and Palov kadi, Gapvu tradiny (Korea) varieites this indication was the same, 95%, while in Kichkintoy – 80%, in Korean Pumpkin vareity 85%, for Voljskaya Seraya variety – 90 %, for Mamordika – 55%, Kashkar 1644 variety – 95%, and for Ispanskaya gitara variety it made 90%.

Phenological observations were conducted during the years to study vegetation period of varieties which were planted for experiment. In the result of observations it was found out that the gross germination was noted in seeds (May 1-10), then 10 pieces of plants from each variety were separated for control and study. Experiments were carried out on their growth and development. According to the results high indication on their growth and development was noted in all varieties (July), but the highest indication was observed in Kormovoy variety – 110 cm, the lowest result was in Mamordika variety – 45 cm. In August Ispan 73 and Non kadi varieties grew the most, that is, 150 cm among others. The least grown variety was Mamordika, 70 cm.

**Table 2:** Agro-biological and technological parameters of the varieties under the experiment (in 2016-2018)

№	Varieties	Germinability, %	Vegetation period, day	Productivity, t/ha	Amount of dry substance in the content%	Amount of sugar in the content%
<i>Cucurbita maxima</i>						
1	Ispan 73	95	115	20	11	7
<i>Cucurbita pepo</i>						
2	Non kadi	95	105	18	10	6
<i>Cucurbita moschata</i>						
3	Palov kadi	95	102	18	13	8
4	Gapvu tradiny (Korea),	95	120	13	8	4
5	Kichkintoy	80	90	11	10	5
6	Korean Pumpkin,	85	105	12	8	4
7	Voljskaya Seraya	90	115	21	13	8
8	Mamordika	55	103	11	8	4
9	Kashkar 1644,	95	105	19	12	6
10	Ispanskaya gitara	90	105	17	13	7

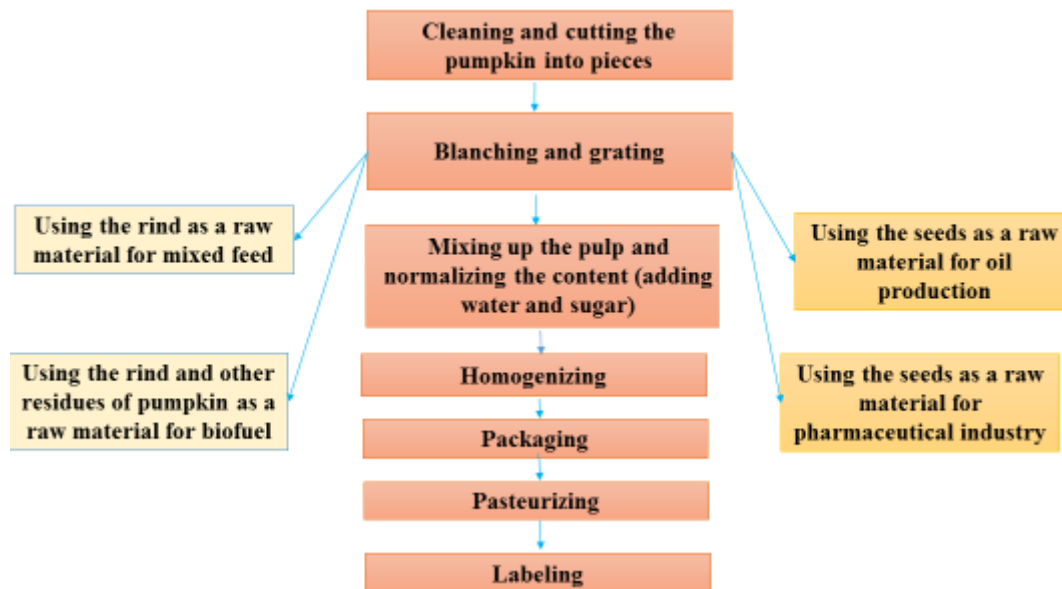
In accordance with the results of conducted observations the flowering and fruiting of plants lasted till June 13. When we checked by varieties, the flowering of Ispan 73, Non kadi, Palov kadi, Kichkintoy, Kashkar 1644 varieties occurred on June 9-10, while in Gapvu tradiny (Korea), Korean Pumpkin, Voljskaya varieties on June 14 and in Mamordika variety it was on June 19. When the observation on fruiting of plants was performed, it was noted on August 23-29.

Furthermore, biochemical content of pumpkin fruits was studied. The highest amount of sugar was found out in Voljskaya Seraya and Palov kadi varieties (8%). The lowest sugar amount was noted in Korean Pumpkin and Mamordika

varieties (4,0%). Also in Non kadi variety the highest indications were observed by other features.

The availability of abundant amount and quality of dry substance in the content of the fruits influences directly on the production of juice. It is obvious by the experiments that the most production of juice was observed in Voljskaya Seraya, Non kadi, Kashkar 1644 varieties (up to 78 %). The lowest juice production was noted in Mamordika variety.

Besides, technological processes were analyzed in the production of juice and a proper technological scheme was developed in obtaining higher juice yield.



**Picture 1:** Suggested technological scheme for the production of pumpkin juice

The aforementioned technological scheme is similar to conventional technological processes. We conducted experiments on the improvement of these processes on two aspects in our research:

- Increasing juice amount in juice production;
- Improving organoleptic peculiarity of produced juice.

Both aspects were studied in some variants during our experiments.

For the first aspect we have tested electropulsation, enzymic and heat treating (pasteurizing) methods. Hereby, in the result of heat treating method the yield of juice made 8 %, by electropulsation and enzymic treating juice yield has increased by 4,6 and 5 % respectively.

For the second aspect we had to find solution to the issue of improving taste features of pumpkin juice. At the same time the main attention was paid for developing a right suggestion on mixing pumpkin juice with other fruit juice of high sourness. During the investigation sour apple juice, lemon juice and beetroot juice were mixed with pumpkin juice and a proper ratio was studied in the experiment. In a result of experiments it was determined that when 7% lemon juice was, 12 % apple juice and 18 % beetroot juice were added to pumpkin juice, its degustation value was satisfactorily good. Particularly with beetroot juice, the pumpkin juice was perfect with a special color.

#### 4. Conclusions

The selection of juicy pumpkin varieties and the technology of their juice production were investigated in Tashkent region condition in the years 2015-2018, and as result of the survey it was concluded as follows: for the production of juice *Cucurbita maxima* - Ispan 73, *Cucurbita Pepo* – Non kadi, *Cucurbita moskata* – Palov kadi, Voljskaya Seraya varieties among the selected varieties could meet the requirements for nutritive content and juice yield.

For juice production the use of heat treating method is

considered the most proper one in order to increase juice yield. Under this method organoleptic indication of juice can be kept in an appropriate level.

Mixing pumpkin juice with apple juice, lemon or other fruits and vegetable juices with high sourness for improving organoleptic peculiarities of pumpkin juice, gave a positive result. Particularly, the taste of pumpkin juice mixed with 7 % lemon juice was evaluated highly.

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