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Multifunctional Technological Line for Production of Chismicheon the Basis of New Highly Effective Technical Means

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ABSTRACT. The article is devoted to the problem of integrated grape processing and production of raisins. A detailed instrumental - technological arrangement of the line with a description of the main machines and devices developed in the course of many years of research is given. Over the past decade, the results of the work performed were four apparatuses that form the basis of the production of mold-making: a grape mechanization blancher, a solar-energy drying installation, a vertical comb separator and dried grape vibrating screen of Uzbekistan No. FAP 01024, No. FAP 01063, No. FAP 00834 No.FAP 00998).Describes the design, the principle of their work, a brief technical specifications and operating parameters.

KEYWORDS: Grapes, berry, blanching, solution, rotor, drying, two-chamber dryer, temperature, oscillation, humidity, comb separator, dismembrator, blow, crash, cell

I. INTRODUCTION

The current level of development of dried fruit and sunflower seed production in Uzbekistan depends primarily on the state of the raw material base: yields and areas occupied by fruit and berry gardens and vineyards. At present, the area of vineyards is more than 200 thousand hectares. and in 2018 more than 1314 thousand tons of food grapes were grown and 65 thousand tons of dried grapes were produced. From year to year, the growth dynamics of dried grape products (raisins and raisins) noticeably increases, and by 2020 its production should be increased to 100 thousand tons, with a population of 32.7 million people, per capita will be 3 , 06 kg. For comparison, in the CIS countries in 2015 only 63 thousand tons were produced. dried fruits, that per capita on average was 220g, at a rate of at least 1800g. Therefore, about 60 thousand tons are imported into these countries annually. raisins and raisins.

The United States and Turkey are the main producers and exporters of these grape products on a global scale, while Uzbekistan ranks ninth in this row and exports are about 26,000 tons [1].

Multi-tonnage processing of grapes to sunflower seed (using the examples of the Turakurgan Dried Fruit Combine and the Samarkand Cannery) does not provide production of high export – oriented quality due to technological reasons, or disruption of the operation of complex, energy-consuming apparatuses. Moisture heat treatment of grapes is carried out in a BK-6 bucket blancher, and drying is carried out on a belt conveyor drying unit Sandvik (Sweden). The berries burst and, when dried, encased around them, reducing the quality of the raisins. Therefore, analysis and research of the production processes of sunflower seeda showed the need to improve the technology of processing grapes and create simple and less energy-consuming technical equipment suitable for operation in conditions of medium-sized farms engaged in the cultivation and processing of grapes. In this regard, an important priority is the task of creating mini-technological complexes ensuring the production of export-oriented grape products.

II. SIGNIFICANCE OF THE SYSTEM

In this article is devoted to the problem of integrated grape processing and production of raisins.The study of literature survey is presented in section III, methodology is explained in section IV, section V covers the experimental results of the study, and section VI discusses the future study and conclusion.

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III. METHODOLOGY

Given the identified shortcomings of the existing technical means for processing raw grapes, create small-scale versions of a rotary blancher, a two-chamber energy-saving convective dryer, comb separator and vibrating screen for dried grapes.

IV. EXPERIMENTAL RESULTS

On the basis of the machines and devices developed by us, a technological line for the processing of grapes for raisins was created (Fig. 1).

Grapes after harvesting, with a sugar content of at least 25%, are delivered to a centralized processing center. This can be organized by combining several private farms. Since the volume of grape processing is seasonal, a set of equipment can be acquired by several firms in a "club" with a shared financial investment or bank lending. After delivery, the grapes are manually inspected on the TSI-1.5 (2) conveyor, sorting and removing substandard and unripe berries, divide the large clusters into hooks and serve to the MBV-1 blancher, which is used for short-term moisture-heat treatment 0, 3-0.5% NaOH solution.

The blancher (Fig. 2–3) [2] contains a bath 1 with a perforated partition 2, a rotor 3 mounted on the bath with boxes 4, a loading paddle dispenser 5, a discharge tray 6, a drive 7 and a system of basic heating elements 8. Each perforated box 4 is a boxa container with a lid 9 with an interconnected spring 10. The blancher is equipped with copiers 11, made as part of an Archimedes spiral and fixed mirror-like on the side walls 12 of the bath. The system of heaters 8 is located between the partition 2 and the bottom of the bath. A semi-cylindrical chamber 15 with through channels 16 equipped with jet pumps 17 is freely mounted on the rotor shaft 14.

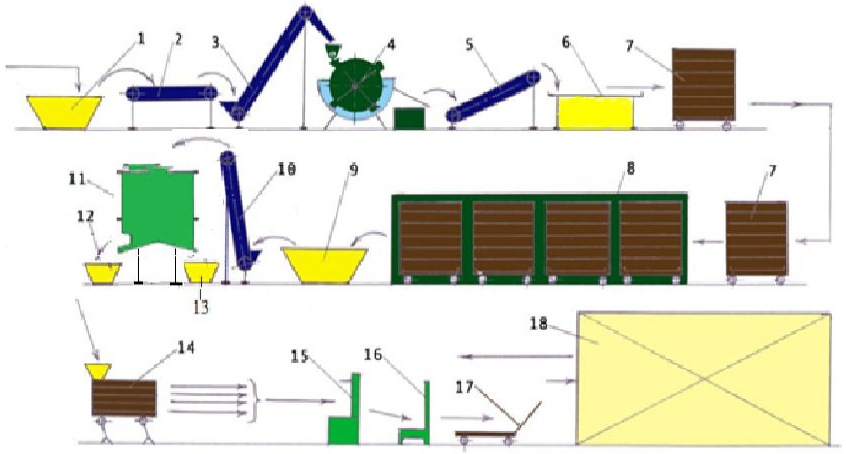

Fig.1. Instrumental - technological complex line for processing grapes for raisins
1.Fresh grape receiving bin; 2.Sorting and inspection conveyor TSI-1,5; 3.Steeply inclined TLK-2 conveyor; 4.Blancher MBV-1; 5.Inclined conveyor TLN-3; 6.Accumulative table; 7.Food cart; 8.Solar - fuel drying installation STSU-2EM; 9. Bunker for dried grapes; 10.Steeply inclined conveyor TLK-3; 11.Vertical ridge separator of dismembrator type VG-1; 12.Capacity for soda; 13. Capacity for the ridges; 14.Vibrating screen; 15.Packing machine; 16. Household scales; 17. Truck trolley; 18. Refrigerator-warehouse

Heating elements 18 are installed between the channels of the chamber, and the cavity of the chamber is filled with heat-accumulating substance 19, which is sodium crystalline hydrate phosphate. The rotor shaft 14 and the dispenser 5 operate from the drive 7 through chain drives.

The grape blancher works as follows. Before starting work, bath 1 is filled with technological solution (0.3 ÷ 0.5% NaOH solution) to a predetermined level, then at the same time the rotor 3 drive 7 is turned on and the heating elements system 8 and 18 are turned on, as well as pumps 17. At the same time, the flow created by the pumps is directed in the direction opposite to the rotation of the rotor.

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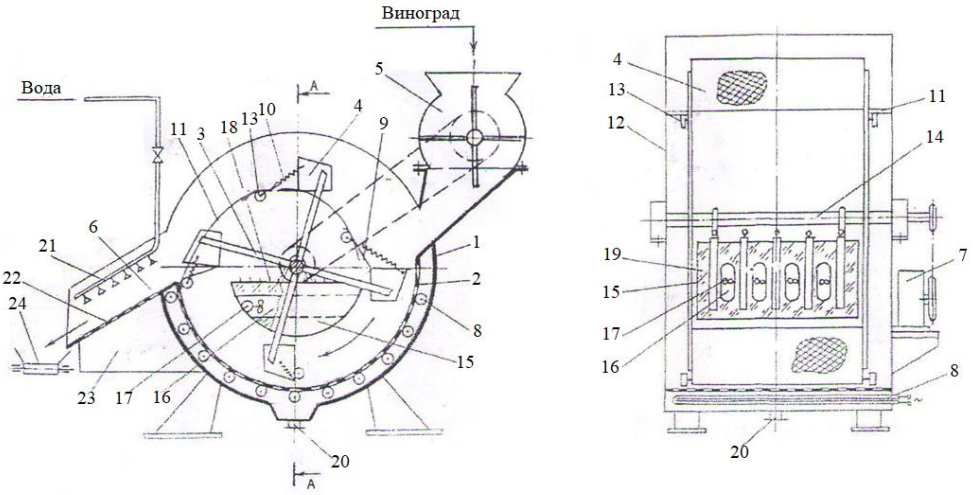

Fig.2. Rotary blancher Fig.3. Section A-A in Fig.2. BIE-1;

Single run-up finish to a temperature of about 98-100°S. Upon reaching the temperature stabilization of the entire apparatus, through the blade dispenser 5, grapes in portions of 2,0 – 2,5 kg are fed into the box in portions.

In this case, the grapes come in one or another box, cyclically passing the tray. As the rotor 3 rotates, the loaded box is immersed in the technological solution, and the roller 13 of the cover 10 under the force of the spring 9 closes the box. Next, the box with grapes undergoes heat treatment fully recessed in the solution, and near the perforated partition 2, the grapes are intensively subjected to treatment with ascending streams of boiling solution. Since the main heating elements 8 provide bubble boiling of the solution, the heat-accumulating chamber 15 additionally heats the working solution and thereby compensates for the heat loss caused by the absorption of heat in portions of the incoming grapes.

Due to the change in the spatial position of the box, the grapes in it roll over, which ensures uniform processing of all fruits, and the grid of the skin permeability is uniform. When the rotor is stabilized, the main mass of the solution is pumped by pumps 17 through the through channels 16 of the chamber 15, forming a stable circulation loop providing the best heat exchange. The solution is additionally heated by the energy of the heating elements 18, placed in the plastic mass 19 of sodium dihydrogen phosphate. Further, at the exit of the box 4 from the solution, the roller 13 of the cover 10 comes into contact with the cam 11, the cover slowly moves away and at the discharge chute 6 (4th quadrant) the grapes come off on the perforated sheet 22 where it is subjected to cold water. Water flows into collection 23, and the grapes are reloaded onto the conveyor 24. After being freed from the grapes, the box continues to contact the copier, the lid 10 is fully opened in the 1st quadrant, at the next turn of the rotor, again loaded with a new batch of grapes.

Technical characteristics of MBV-1 blancher:

- •maximum performance, kg/h -180…..2000
- •power consumption, kW – 20,0
- • bath diameter, mm – 1000
- • bath width, mm – 400
- • diameter of the rotor, mm – 800
- • rotor speed, min - 1 – 4,28
- • number of baskets, pieces – 4
- • basket capacity, kg to 2,0

The decisive link in the production of sunflower seed is the process of drying the grapes. Dropped grapes laid out on pallets and placed them on grocery carts. A general view of the solar - power drying system STSU - 2EM is shown in Fig.4. [3]

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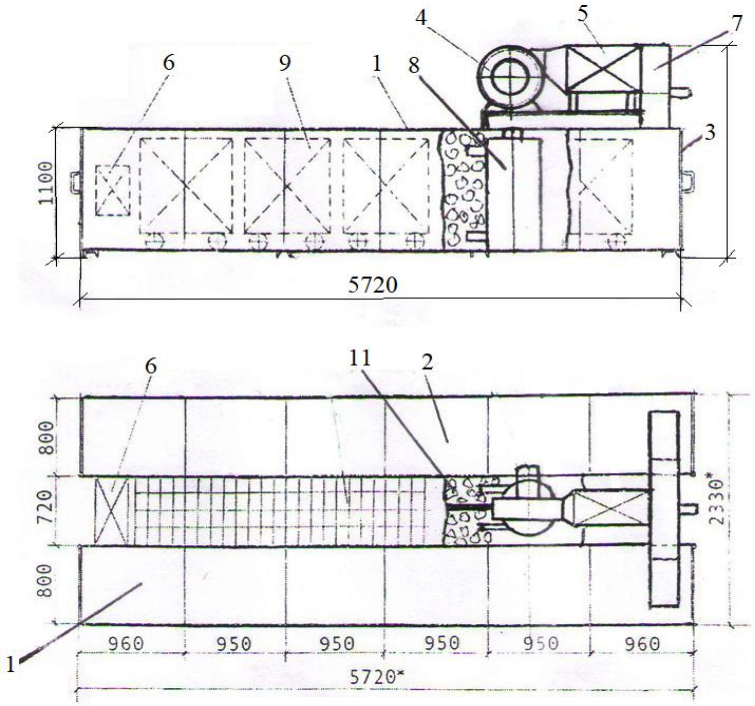

Fig.4. Solar - energy drying unit for agricultural products STSU - 2EM

The drying unit contains rectangular section working chambers 1 and 2 with doors 3, fan 4, main 5 and intermediate 6 electroheaters, oscillating channel 7 and air distribution manifold 8. Each chamber houses five multi-shelf food carts 9. The outer surface of the chambers is painted with black enamel, and the space between the chambers is divided by a partition 10 and filled with heat-accumulating elements 11, which are used as rubble stones. The air distribution manifold 8, made in the form of a cylindrical closed tank with two nozzles 12 in its lower part for receiving and exiting coolant, is equipped with a rotary vane valve 13 V-shaped, and in the upper part is a window 14 communicating with the suction fan nozzle 4.(fig.5).

Drying of grapes is as follows. Filling both chambers with carts tightly close the doors 3 and turn on the air and heat supply system: fan 4, electric air heaters 5 and 6. At the same time, air from the inter-chamber space through pipe 12 enters the auxiliary distribution manifold 8 and through the suction pipe 14 enters fan 4

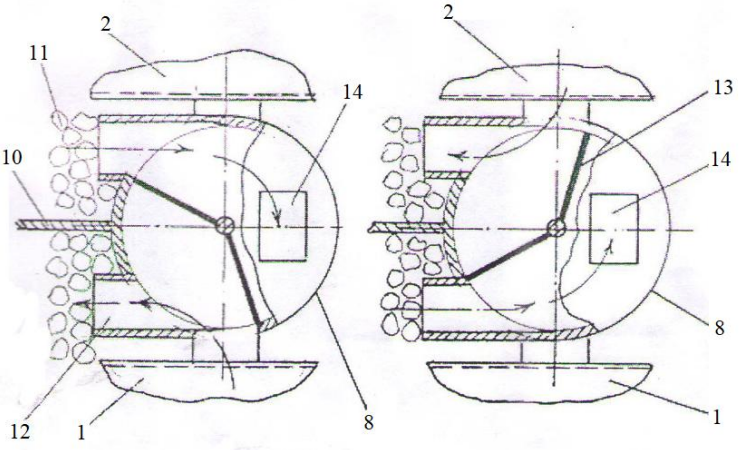

Fig.5. Schemes of motion of the coolant with oscillating drying mode

The latter pumps air through the main electric air heater 5, in which it heats up to a predetermined temperature t ≤ 55-0C and through the oscillating channel 7, depending on the position of the butterfly valve, one of the sleeves

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enters chamber 1, in which it blows the product laid in the carts. When this occurs, the convective heat exchange between the hot air and the product, during which the moisture evaporates, and the air temperature drops. Next, the air passes through the intermediate electric air heater 6, is again heated to the required temperature and enters the working chamber 2, in which the further process of drying the product takes place. Exhausted low-grade air with a temperature t = 40 - 45 ° C from chamber 2 through channel 7, one of the nozzles 12 is removed into the inter-chamber space to heat the heat-accumulating substance 11. At the same time, it is partially heated, retaining heat, to return fresh incoming air when changing direction flow, i.e. oscillations. As is known, the oscillation regime intensifies the process of removing moisture from the product, since the gradients of temperature and moisture content coincide and are always directed from the deeper layers of the body to the outside. The oscillation period for each product is selected individually, for example, for drying grapes, the time for changing the direction of air flow (optimally) is selected within 40 - 45 minutes.

Thus, by optimizing the design arrangement of the elements of the drying unit, its thermal performance and efficiency increase, while saving heat is 27–28%, including 14–15% of incoming solar radiation and up to 14% due to regeneration heat

Mass - overall and technical - technological characteristics of the experimental installation STSU - 2

EM:

- two chambers: length - 5720 mm; width - 2330 mm; height - 1910 mm;
- number of carts - 5 in each cell;
- fan - VS - 4 - 70 № 5; V = 6000 m^3/ h;
- electric heater – PGS - 018 V, two pieces at P = 10 kW;
- one-time loading (for grapes) 720 - 750 kg / cycle;
- drying temperature - t = 50 - 80 °S;
- drying time to - 36 h.

After drying, the dried grapes are unloaded into the collecting bin 9 and, as necessary, processed at the ridge separator 11 (Fig. 1).

The vertical comb separator developed by us with the vertical arrangement of the working shaft is shown in Fig. 6

A BP-100 comb separator for separating grapes from the ridges includes a housing 1 with an outer 2 and an inner 3 shells located with an annular gap, a charging funnel 4 mounted on bearings 5 and 6 on a working shaft 7, on which one similarly to the other disassembler is mounted 8 and 9, each of which has a movable 10 and a fixed 11 discs, and nozzles 12 and 13 for separate collection of berries and crests. On the disks 10 and 11 of dismembrators, along rows of fingers 14 are mounted on concentric circles, large toroidal elements 15. Each finger 14 in the row of the peripheral circumference of the movable disk 10 of the dismembrator 8 is mountedrotatably on the bearing 16 and has a friction roller 17 for interaction with the ring band 18 fixed on the inner shell 3

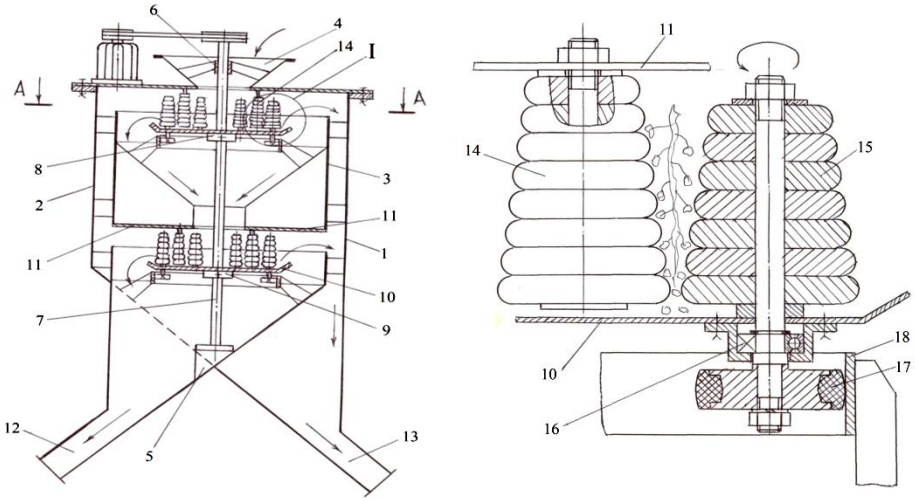

Fig.6. Vertical comb separator VG-100

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Each finger 14 dismembrator 8 and 9 is a set (package) of toroidal elements and form a conical shape facing the base downwards, and the elements 15 are parallel to the disks 10 and 11 and made of elastically deformable material, for example, rubber.

The device operates as follows. Dried grapes with crests are fed through a feed funnel 4 into an apparatus in which, when they fall on the movable disk 10 of the dismembrator 8, they are thrown by centrifugal forces from the center of the disk to the periphery. Repeatedly falling into the gap formed between the fingers 14 of the movable disk 10 of the dismembrator 8 and the fixed fingers mounted on the disk 11, the crests of the grapes are subjected to intensive mechanical processing, as a result of which a part of the grapes is detached from the stalks and crests and, due to centrifugal force, is rejected to the periphery. According to the laws of physics, berries that are more dense than ridges and stalks are dropped over the edge of disk 10 and fly much farther and enter the annular gap between the outer 2 and inner 3 shells. The crests and part of the brushes of dried grapes which are not destroyed during the passage through the maze of fingers 14 descend from the disk 10 of the dismembrator 8 into the cavity bounded by the inner shell 3, from where they come to the movable disk 10 of the dismembrator 9, on which the process of additional processing of the grapes occurs, similar to the process on the dismembrator 8 At the second level, the remnants of the crests with the grapes are in contact with the fingers 14 of the second dismembrator 9 and are completely destroyed. Berries and combs together with the stalks are retracted separately by nozzles 12 and 13.

Such a constructive solution provides an increase in technological efficiency. installation and minimizes damage to grapes.

The processing mode proceeds in a sparing mode, since the profile implementation of the fingers in the form of a truncated cone ensures the formation of a wedge-shaped gap between the rotating fingers and the fixed ones. At the same time, brushes, bunches of grapes pass this active area from top to bottom, gradually decreasing in volume. In the lower part of the width of the gap between the pairs of fingers, they slightly exceed the maximum size of the raisin berries. The manufacture of toroidal elements (rolls) from an elastically deformable material (rubber) contributes to the soft impact of the berries on the surface of the fingers. The fingers are made of removable rolls of different sizes in diameter for quick replacement in case of failure of one of them.

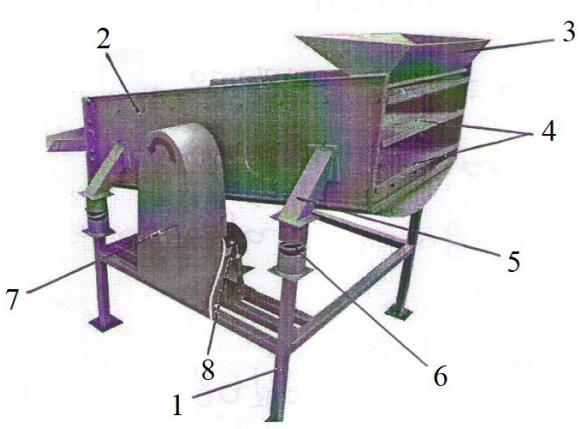

Fig.6. Vibrating screen for VK sunflower seed fractionation – 100

The proposed installation is advisable to use in small and medium-sized farms, as it has small weight and size characteristics, is mobile and easy to manufacture.

Technical characteristics of the comb separator VG-100.
Purpose: recommended for use in private farms and farms;
Estimated capacity, kg / h –to 100;
Installed power, kW - 0.5;
working voltage; B - 220;
dimensions; mm
rotor diameter, 500 - width – 700
Height - 1200;
Everything, kg - 65;

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The final operation of the processing of dried grapes is the separation of the sowing mass into fractions, i.e. in size. This is carried out on a three-shelf screen with a multi-cell screening surface (Fig. 6) [5]. The screen consists of, mounted on a welded frame 1, a rectangular box 2 containing a feed hopper 3 and three screening cells 4. The box body supporting knives 5 is attached to the frame by means of a shock-absorbing spring 6. On the frame under the duct is placed the actuator 7, which includes an electric motor 8 and a crank, creating amplitude-frequency oscillations.

The grape mass is poured into the bunker 3 and the drive 7 is turned on, which creates an amplitude-oscillatory motion of the duct 2. In the process of screening, the dried grapes are sifted through the upper cells of the pallets and come down the grooves in fractions.

According to the requirements of GOST 6882-89 sunflower seed divided by the size of the berries into three varieties:

- export-oriented> 12-15 mm
- highest 9-12 mm
- liquid 6-9 mm
- illiquid<6 mm

Sorted sunflower seed stack in cardboard boxes of 15 -20 kg and sent to storage. Estimated productivity of the device is up to 100 kg. fractionated product per hour.

V. CONCLUSION AND FUTURE WORK

1. The proposed multifunctional complex mini-technological line for obtaining dried grapes at the places of growing grape products meets the requirements of private farmers.

2. For the continuous drum blancher of grapes of continuous action, the following are characteristic: (τ = 6-7s) in a weak alkaline solution (0,4-0,5%) at a temperature of 96-98 °S, while the efficiency of heat treatment of grapes in different fractions average:

- for the separated bunches (brushes) Efficiency of processing wine

-hail mass - Kef = 95% at np = 2,6-3,5 min^{-1};

- for whole grapes - Kef = 86% at np = 3,5-4,0 min^{-1}.

3. The use of a 2–x chamber solar-energy convective dryer allows a combined method of heat supply and to dry the grapes in 32-36 hours.

4. Vertical ridge separator WWG-100 provides crushing ridges to 92-94%.

5. The developed technical means are designed for processing 40 tons of grapes per season with the production of 10 tons of high-quality sunflower seed.

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