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PROSPECTS FOR THE MECHANICAL HARVESTING OF HAZELNUT

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ABSTRACT

The aim of this paper is to give some new and not yet investigated results about the experimental pattern of the flow sheet of the hazelnut harvesting machine, dedicated to the processing of technological processes of the nuts harvesting, removal and collection of husks. Because ofthe harvesting of hazelnut is still carried out mostly by hands or the semi-mechanized way in those countries (Turkey, Georgia and other countries) where there are the industrial production of these crops. Therefore, the study of principles of work of fans of the hazelnut harvesting machine, as well as the determination of their aerodynamic characteristics and the discussion of the constructional machine characteristics are given in this paper.

Keywords: Bunker, Camera for grinding, Fans, Hazelnut

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Introduction

Hazelnut is one of the major agricultural products, ranking Georgia among the top five world hazelnut exporters (Mirotadze, Labartkava , Kimeradze, & Avalishvili, 2013). Nowadays there is an especially high demand on hazelnut at the world market. Georgian hazelnut has a great perspective because of high quality and taste characteristics and therefore, it is characterized by increasing demand. Based on laboratory studies, it is found that hazelnut produced in Georgia is distinguished by high caloricity. Indicator of caloricity is 62-72%, which is 7-8% higher than Turkish, Spanish, Greek and Italian varieties (Kochlamazashvili, Kutateladze, & Kandashvili, 2013). At present, hazelnuts are grown on a total area of 5800 ha in Georgia (Mirotadze N. , 2009)

The technological process of the vibratingharvesting machine of hazelnut, itsworking principles and factors influencing it have been studied in the modern world practice. The machine, which aggregated with agricultural tractors, is able to collect the mass of hazelnut between the tree rows. The aerodynamic pneumatic characteristics of hazelnuts, particularly the fruit diameter, weight, thickness, and other ones have been studied and established.

The technological processes and the working diagram of the vibrating harvesting machine of hazelnut have been studied and investigated, which may be used in case of the mechanized harvesting of hazelnut(Mamedov, 2006).

The interruption of the work process of self-harvesting machine was being studied while trees were dropping nuts in the transient period of their maturing. Based on this, the shaker is periodically accelerated and slowed down. In view of this factor, two versions of the vibrating factor have been developed: the vibration and the acceleration of displacement vector of a tractor(Polat, 2007)

The hydraulic type shaker has been investigated during the harvest of peach. We paid attention to the damage of nuts during the harvest. Plastic-containing fabric, nylon cotton and other things were used as the surface material for the study(Guner, 2010).

MaterialsandMethods

The experimental study and processing of the harvesting mechanized means of hazelnut were performed on the internal combustion engine and the electric motor.

Discussion

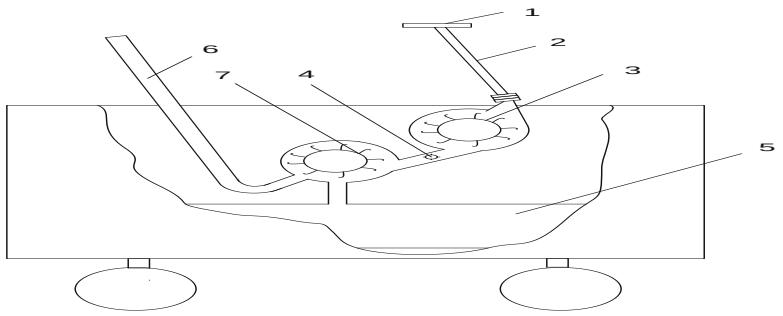
Hence,itIs known that the harvesting process of hazelnuts is associated with some difficulties and features, because it is a native shrubandits nutsaren on homogeno us with the different size.

The processing of the absorbent and pressureair flow of the pneumatic conveying system can be consideredas one of the favored way to solve a problem, inparticular, the harvesting of nuts by means of theair flow absorbed by the fan(Mamuladze, 2009).

It was experimentally found that all kinds of fan are characterized by the difficulty of the complementation of the output mechanism or the steel intensity, thereby the aerodynamic characteristics are being complicated, and the absorbent and pressure air flow are used sequentially in order to enhance these characteristics. The picking of nuts from trees are carried out by the air absorbent flow, which are transferred into the bunker by the pressure air flow.

The torque fan has shown the good result for the realization of the pneumatic conveying system. The aim of it is to transport of hazelnut mass.

The figure (1.1) shows the elementary scheme of the pneumatic conveying system of the hazelnut harvesting machine, which consists of: 1. The sucker, 2. The air tube, 3. The torque fan, 4. The camera for grinding, 5. The bunker for collecting nuts (with two output holes), 6. The tubes for discharging husks and 7. The secondary fan.

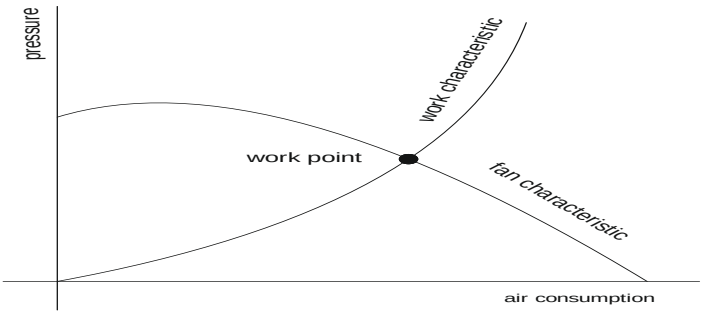


Fig(1.1)The experimental sample of the hazelnut harvesting machine

The fans and circular plate for the grinding in the machine work by means of the internal combustion or electric motor with respect to their coordinated work.G

The flow, absorbed by the fan during the work of aggregate, absorbs the nuts by the sucker N 1, takes them away and transmits them to the fan by the air duct. Then nuts are moved by the influence of air suction into the circular plate for the grinding, where the husks and fruits are segregated from each other, and then the nuts without coats are selected by means of the secondary fans, after which the husks are moved into the bunker for collecting nuts, where they will be distributed.

The constructive calculation and selection of fans are paid important attention for the normal working of the hazelnut harvesting machine. Particularly, it is selected by dependence the aerodynamic characteristics of the air consumption on the working pressure according to the following diagram(Chebisheva, 1973)



NFig. (1.2)aerodynamic characteristics of the fan

The great attention is given to the changeability of pressure because it depends on the resistance of the ventilation system, which is directly linked to the movement of nuts into pneumatic conveying system. This is shown on the diagram 1.3

Diagram C indicates the pressure suppression and the diagram B shows the increase of pressure and if we get a real work characteristic during the work, then the work point will from 1 to 2(Chebysheva, 1973).

Great importance is given to the variability of the rotation number in the work process, particularly, the experimental research showed that the pressure was increased in case of the big rotation of working tireand the work point dislodged from 2 to 4 on the diagram.

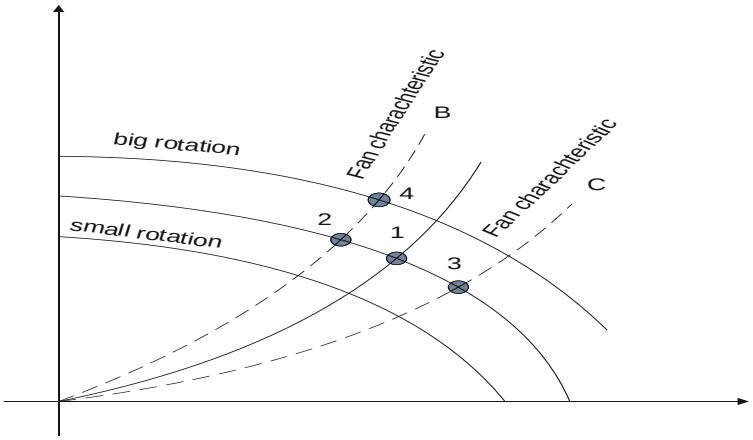


Fig. (1.3)shows the diagram of the variability of the pressure and the rotation number during the work offan

The total pressure of fan (ΔP) was considered during the theoretical calculation of the working parameters. The following formula was used:

$$\Delta P = kq_v^2$$

Whereq_v – is theair consumption (m^3/hr)

k- Constant number.

As the result of the measurement, the pressure of the working fan fluctuate between 100-150 pascal, and the air consumption was:

$$q_v^2 = \frac{\Delta P}{k}$$

Studies show that during 100-150 pascalk≈0,00001.

Then:

$$q_{v_1}^2 = \frac{100}{0{,}00001} = 10000000$$

$qv_1 = \sqrt{10000000} = 3162(m^3/hr)$

$$q_{v_2}^2 = \frac{150}{0{,}00001} = 15000000$$

$q_{v_2} = \sqrt{15000000} = 3872\ (m^3/hr)$

Theexperimentwasconductedontwotypesoffan:

thefanwithbentfrontwingsandthefanwithbenthindwings.The following formula was used:

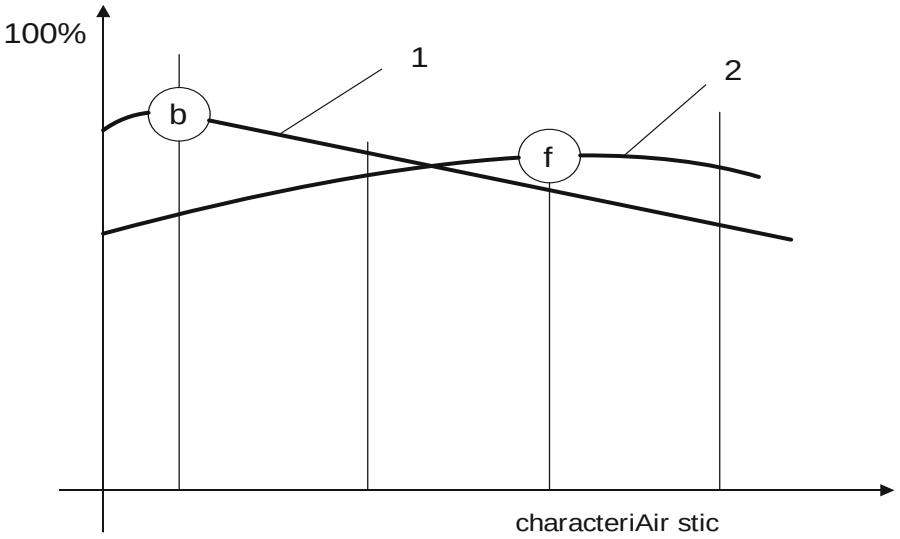
$$\eta = \frac{\Delta P_t q}{P}$$

WhereΔP_t –The total variability of pressure

q – The air consumption (m^3/hr)

P – Force (V)

K-The obtained results were shown on the diagram (Fig.1.4)



1. Fan with bent hing wings
2. Fan with bent front wings

Fig(1.4)The characteristics of the working efficiency of fans

The results showed that the fan with bent hind wings was the most effective than the fan with bent front wings. Hence, we considered to use the fan with bent hind wings in the machine, which showed the positive result in the harvesting of hazelnuts.

Results

Two types of fan were used in the hazelnut harvesting machine according to the different pressures, forces and air the air consumption: the fan with bent front wings and the fan with bent hind wings. According to the conducted experiments, the fan with bent hind wings showed the good result, which provided the hazelnut harvesting machine to work more effectively.

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