INFLUENCE OF THE PHYSICAL CHARACTERISTICS OF CHIVES BULBS ON CHOOSING THE SIEVE TYPE FOR CALIBRATION

Gheorghe BRĂTUCU[1]

Abstract: *The paper presents a research method for the settlement of necessary sieves orifices dimensions which are used at an installation for chive calibrating 2 sorts of chives (spherical and oblong) and 3 types of sieves were experimentally researched. The researchers observed that the sieve which best satisfies the calibration demands of the chive is the sieve with circular improved orifices, which has a double sieving capacity as compared to the one with circular simple orifices. The sieve with bars has an increased sieving capacity, but it doesn't meet the demands regarding the product purity. For a flow of 1000 kg/h the necessary surfaces of the sieves for standard sorts of chives were calculated, and then the share of these sorts in the total quantity of product was established.*

Key words: *chives, conditioning, calibration, sieves with orifices.*

1. Introduction

At harvest time the chive represents a blend of bulbs with diameters ranging from 3 to 35 mm and various vegetal impurities, stones, soil etc. In view of delivery to the production units, of hectare norm settlement, as well as for mechanization of the planting operation, this must be separated on dimension groups. In compliance with STAS 5910 the chive is classified as follows (after the bulbs dimension): sort I - bulbs with the diameter between 7…14 mm; sort II - bulbs with the diameter between 14…20 mm; sort III - bulbs with the diameter between 20…25 mm. The first two sorts are destined for the onion production and sort III for the bunch onion. There are admitted bulbs from one sort to another in proportion of 5% [1].

Because the chives bulbs have round or oblong forms and they are covered with leaves that have weak adherences to the seed surface, as well as because the terminations at the two extremities are roots and tails, the calibration operation is difficult. To this purpose it is necessary to determine the physical characteristics of the bulbs and depending on these to subsequently assure the enforced accuracy of calibration, a satisfying productivity on the optimum processing period and minimum damage of the product [3].

2. Material and Method

The researches were done on two sorts of chives, i.e. Stuttgarter Riesen and Auxonne, for which the specialized literature provides data that may be compared with the research results in this paper. In view of choosing the right sieves and dimensions in order for the

[1] Dept. Food Products Engineering, *Transilvania* University of Braşov.

chive calibration to be done according to the demands, the characteristic dimensions of the bulbs were determined through measurements, respectively the diameter and the length to those two kinds of chives. The measurements were accomplished with the caliper on 1000 of bulbs from a medium sample, the data obtained being allocated on intervals of class and written in tables.

The class interval size was established according to the oldest and the lowest value measured, using the relation [2]:

$$\lambda = \frac{d_{\max} - d_{\min}}{i_0}; \; \lambda = \frac{L_{\max} - L_{\min}}{i_0}, \qquad (1)$$

where: λ is the class interval ($\lambda = 3$); $d_{\max}$, $d_{\min}$ - the maximum and minimum diameters of the chive; $L_{\max}$, $L_{\min}$ - the maxim and minimum lengths of the bulbs; i_0 - the number of measured bulbs.

Analyzing the form of the curves depending on the dimensions distribution, the dimension at which the chive is more homogeneous was established, in view of choosing the sieve type for separation.

Because of the very varied forms and dimensions of bulb chives, many types of sieves were analyzed, establishing their sieving capacity for chive. There behavior of some sieves with circular simple orifices, with circular improved orifices and with bars was monitored, the distance between bars being equal to the diameter of the circular orifice. These sieves were mounted on a sifted laboratory machine (Petkus K-294) adjusted for chives.

The orifices' form was chosen by taking into consideration that the sieve should have a big working capacity and should assure enhanced separation purity. The orifices' dimensions were selected depending on the separation sorts specified in standards.

In order to establish the material constitution of the sorts from the gathered samples the curve of the cumulate frequencies was drawn, from which directly resulted the percentages for those 3 sorts of chives (7…14 mm; 14…20 mm; 20… 25 mm).

If the structure of the material is known the working surface of the separation sieves for an enforced flow can be determined using the relation:

$$Q = q_F \cdot F \; \text{[kg/s]}, \qquad (2)$$

where: q_F - is the admissible flow, in kg/m^2s; F - the surface of the sieve, in m^2.

3. Results and Discussions

The measurements' results on the chive bulbs from the Stuttgarter Riesen kind are presented, after being remade, in Figure 1 and for the Auxonne kind, in Figure 2.

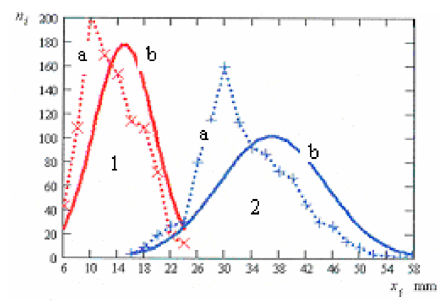

Fig. 1. *The experimental distribution curves* (*a*) *and theoretical* (*b*) *for the Stuttgarter Riesen sort:* 1 *- according to diameter;* 2 *- according to length*

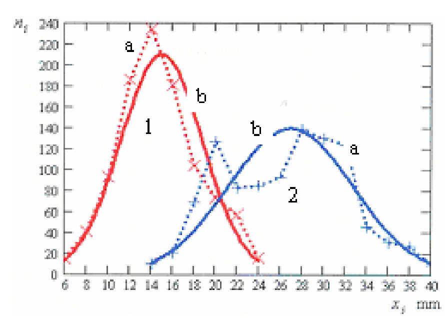

Fig. 2. *The experimental distribution curves* (*a*) *and theoretical* (*b*) *for the Auxonne sort:* 1 *- according to diameter;* 2 *- according to length*

The analysis of the measurements' result shows that the Stuttgarter Riesen chive sort is characterized by oval bulbs, with diameters ranging from 6 to 25 mm, and the length ranging from 14 to 40 mm. The most frequently occurring diameter is of 15 mm, and the most frequently recurring length is of 27 mm; the result is that the average length of the bulbs is almost two times higher than the diameter.

Likewise, it results that the Auxonne sort is characterized by more oblong form bulbs, the average diameter being of 11 mm, and the length of 33 mm. From these values it results that the average length to this kind is 3 times greater than the diameter, the class intervals of the length being situated between 16…58 mm.

By analyzing the distribution curves in view of these considerations, it result that the distribution curve of the diameter of these two sorts of chives has a more oblong form, the dimensions' interval is smaller therefore the separation can be satisfactorily accomplished according to this dimension.

The dimensions of the separation sieves, as well as of the orifices of their active surfaces are established depending on the chive structure for each one of the three separation categories. These dimensions are imposed by the specified demands, namely: for the separation sort III the orifice dimension must be of 20 mm; for the sort II of 14 mm, and for the sort I of 7 mm.

The main forms of orifices encountered at ablution and assortment sieves are circular and oblong. Because the chives bulbs have various forms and the diameter of the same type of seed is unequal, the circular orifices, which are characterized trough one single dimension, stop the sieving of bulbs with different diameters.

For the separation through circular orifices, the chive must be situated vertically against the sieve surface. Because this condition presents some difficulties, especially for the sorts displaying significant differences between dimensions (Auxonne), the possibility of using two types of sieves with circular orifices and a sieve with parallel bars was analyzed. The circular orifices were normal in the first case and improved in the second case. In the case of the sieve with circular improved orifices, the orifices are improved downwards so that the superior surface of the sieve forms a frustum cone with the base positioned upwards which improves the vertical placement of the bulbs on sieves. The results obtained in research made on three types of sieves are presented in Table 1.

It can be noticed that in the time unit a double amount of product passes through the circular improved orifices as compared to the circular simple orifices, and through the parallel bars sieve it passes a 10 times larger amount than through the improved orifices. The parallel bars sieve also separates according to the minimum dimension of the bulbs' diameter, thus having a more consistent crossing, only that a distance between bars which is equal to the diameter of the circular orifice doesn't assure the necessary separation accuracy. This drawback can be partially overcome through choosing a more diminished distance between the sieve bars, depending on the diameter in uniformity.

Having established the form and the sieve orifices' dimensions, its surface for an

The sieving capacity of the sieves with orifices of different forms Table 1

Orifices type	**Chive quantity, [g]**		**Probe time, [s]**	**Crossing capacity, [g/s]**
	Crossed trough the sieve	**Remained on the sieve**		
Normal circular	950	50	60	15.8
Improved circular	955	45	30	31.8
With parallel bars	1000	–	3	333.0

enforced flow was determined. Because of the material that will be divided into three sorts, the three sieves were dimensioned according to the amount of material that should come back from the blend for every sieve. That amount of material was established by percents throughout the initial measurement.

Considering that the separation is done with ascertainable equipment, for instance the winnower VM - 4, whereat the sieves' width B is known, their length L was calculated and, by default, their surface using the relation:

$$F = B \cdot L = \frac{q \cdot Q}{q_F} \ [\mathrm{m}^2], \tag{3}$$

from were:

$$L = \frac{q \cdot Q}{B \cdot q_F} \ [\mathrm{m}], \tag{4}$$

in which: B = 0.85 m (the sieve width for the winnower VM - 4); q - the blend percent what comes back on a sieve; q_F - the admissible shipment of a sieve: $q_F = 0.3$ kg/m^{2}s.

In Table 2 are specified the values of the lengths and sieves surfaces determined for a flows Q = 1000 kg/h, taking into consideration that the sieves width is of 0.85 m.

The table shows that in the case of chive separation with the Auxonne kind, the sieves' dimensions must be greater than for the Stuttgarter Riesen kind, this confirming the previous conclusions, respectively the fact that the Auxonne kind is more difficult to separate, on account of the fact that bulbs have an oblong shape.

Sieves parameters for chive calibration Table 2

Sieve for the sort	Chive kind								VM – 4	
	Stuttgarter Riesen				Auxonne				L, [m]	F, [m^2]
	q, [%]	qQ, [kg/s]	L, [m]	F, [m^2]	q, [%]	qQ, [kg/s]	L, [m]	F, [m^2]		
I	100	0.28	1.1	0.94	100	0.28	1.1	0.94		
II	95.5	0.26	1.0	0.85	98.7	0.27	1.06	0.90	0.88	0.75
III	43.8	0.12	0.47	0.40	82.8	0.23	0.9	0.76	1.76	1.50

4. Conclusions

- The chive calibration on groups of dimensions is necessary because the harvested blend has varied dimensions and forms, and for the drilling mechanization and for the settlement of seed norm per hectare the material is required to be homogeneous.
- For the chive separation according to bulbs' dimensions the diameter and the length variations of two kinds of chive were analyzed, resulting that the corresponding calibration dimension is the diameter.
- The use of a parallel bars sieve doesn't assure the proper purity, and the sieve with circular simple orifices has a reduced sieving capacity.
- In view of choosing the sieve type for separation, three kinds of orifices were analyzed: circular simple, circular improved and with parallel bars, which led to the conclusion that a precise and efficacious separation can be obtained by using the sieve with circular improved orifices.

References

1. Berceanu, D., Chira, A.: *Horticultural Product Conditioning*. In: Horticultura **9** (2003), p. 17-24.
2. Rus, F.: *Operaţii de separare în industria alimentară* (*Separation Operation in Food Industry*). Braşov. *Transilvania* University Publishing House, 2007.
3. Segărceanu, M.: *Studiul sistemelor de separare a seminţelor prin sitele plane* (*Study of Seeds System Separation trough Plane Sieves*). Institutul Politehnic Bucureşti Publishing House, 1978.