HAZELNUT HARVEST, CALIBRATION AND SHELLING

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Introduction

Hazelnut harvest is one of the more expensive operations, why the equipments demand to do so, is one of the more important research subject in this culture production.

The existence of several types of harvest equipments are not the answer to the particulars Portuguese orchards, because the small ones have a low work rate and the biggest are too expensive.

Equipment used in Portugal

Some harvest solutions (backsack, trailed and self-propelled)

Purposes

- create a small harvest equipment, with low cost, that could improve the collection work rate;

- create a calibrator, with low cost, to differentiate the product by size;

- create a shelling equipment, with low cost, to shell the hazelnuts.

Material and methods

The hazelnut harvest AGRO 162

Constitution

- a hopper;
- a four stroke engine;
- a ventilator;
- two flexible tubes;
- a wheelbarrow.

Operating

The engine drive a ventilator, mounted in its shaft, which works inside a carter where is created the suction that, through two flexible tubes, allow the material aspiration.

The more weight material, due to the friction against the inside hopper wall, deposit in hopper bottom being, the light one, transported to the outside.

Harvest

The harvest work rating is significantly improved when the ground is regular, dry and clean.

- regular ground (flat soil) allow to near the fruits making easier its aspiration;

- the wet soil makes more difficult the hazelnut suction and makes the aspirated soil to settle inside the tubes and hopper, decreasing the suction capacity;

- the presence of plants, special cloves, makes more difficult to see the fruits and the end tube adhere to the vegetation, making the operation more hard;

- the presence of leaves and branches reduce the work rate and takes more time to clean the aspirated material.

Material not stripped

Material stripped

Two stripped material

Material harvested in wet conditions

Material harvested in dry conditions

Nut cleaning

Calibrator AGRO 162

Constitution

The calibrator is built by three iron sieves mounted in slope positioned, to allow the hazelnuts rolling. The sieve grade are 18.0, 16.0 and 14 mm.

The sieves can be mounted one below the other or one after the other.

When one is below de other in the upper position is the bigger grid which leave to pass the small hazelnuts to the follow ones; the smaller hazelnuts are kept in boxes positioned in the ground, below the equipment.

When the sieves are ones after the others the smallest hazelnut is the first to pass the sieve. In this situation below each sieve it mounted a cloth structure, in funnel shape, to conduct the hazels to boxes, preventing them to fall down to the ground.

Sieve positioned ones
under the others

Sieves positioned ones
after the others

The shelling equipment AGRO 162

Constitution

The shelling equipment is, basically, built by a metallic roll, drive by an electrical engine, with two welded metallic rulers, positioned according the generating roll; these rulers, help the hazelnut transport the fruits until a wood ruler where they are shrink.

The hopper bottom has a opening that is regulated for leaving pass more or less fruits.

Regulation

The main adjustment of this equipment is relationship with the distance between the roll and the wood ruler. This regulation is done turning a crank that allows the wood ruler approach to the roll.

This distance must be lower than the bar sieve distance and must be defined by attempts, until we have a good shell fruits percentage and low break kernel.


Hopper
Electrical engine
Transmission
Basket to receive the shell and nuts

Results

The available results reports only to a trial year why they must be faced with some care.

Hazelnut collector AGRO162

Tests realized in good conditions, with the material spread in the ground (not stripped)

Partial results:

- collection time 33-34 h/ha (± 3 min/tree); distance among trees 3 x 5 m, average production 1335 kg/ha (667 trees * 2 kg/tree);

- empty hopper time, 2-3 h/ha (1335/25*3 ≈ 3 min/hopper); the hopper is empty when it has 25-30 kg.

- other times (fill the engine tank, clean the tubes and hopper, etc.), 2-3 h/ha.

Total average equipment utilization time, considering the factors mentioned, is ± 40 h/ha.

Hazelnut collector AGRO162 (cont)

Tests realized with stripped (± 1.5 m width) material, in dry and wet conditions.

Partial results:

- collection time 17-25 h/ha, (10-15 min, for 20 m of strip length). For 3 x 5 m distance among trees, corresponding to a 2000 m strip/ha;
- empty hopper time, 2-3 h/ha (1335/25*3 ≈ 3 min/hopper); the hopper is empty when it has 25-30 kg.
- other times (fill the engine tank, clean the tubes and hopper, etc.), 2-5 h/ha.

Total average equipment utilization time, considering these situations vary from 23 h/ha (10 min/20 m) to 33 h/ha (15 min/20 m), corresponding to the dry and wet conditions.

Hazelnut collector AGRO162 (cont)

Average times, in hours, to collect hazelnut

	Stripped material		No stripped material
	Good conditions	Bad conditions	Good conditions
Collection	17	25	34
Empty the hopper	3	3	3
Others (fill the tank, clean,)	3	5	3
Total	23	33	40

Considering a manual harvest work rate of ± 6 kg/h, a average production of ± 1340 kg/ha, takes ± 225 h/ha.

Hazelnut calibrator AGRO162

Hazelnut size diameter of different lots, in mm

	Size grade 1 (< 14 mm)	Size grade 2 (14 - 16 mm)	Size grade 3 (16 - 18 mm)	Size grade 4 (> 18 mm)
Minimum	10.92	14.28	16.19	17.89
Maximum	14.72	17.58	19.12	22.56
Average	13.75	15.91	17.23	19.65
Standard deviation	0.72	0.68	0.56	0.97

Shelling equipment AGRO 162

The lots of the biggest hazelnuts are easier to shell because exist some space between the shell and the kernel.

The average results got with this equipment are the follow:

Lots sizes (mm)	Intact hazelnuts (%)	Shell hazelnuts (%)	Broken kernel (%)
> 18.0	10	85	5
16.0 – 18.0	5	80	15
14.0 – 16.0	15	70	15
< 14	10	65	25

Conclusions

- the hazelnut orchard conditions are essential to get the better performance of the harvest equipment;
- the vacuum hazelnut equipment is a cheap machinery that allow to increase significantly the work collection rate, especially when the material is previously stripped;
- the performance of calibrator equipment, to get homogenous lots, is determinant to the shelling equipment;
- inside each lot, when the size standard deviation is high, is better to shell the hazelnuts in more than one stage, beginning with the high metallic roll - wood ruler distance, diminishing after the distance;
- as the hazelnuts are smaller more difficult is shelling them because the kernel is to close to the shell;
- the performance improvement of these equipments is fundamental to keep the hazelnuts Portuguese orchards in production.

Thanks