Performance of the "Oli-Picker" olive harvester in Trás-os-Montes region of Portugal

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Summary

Trunk and bough shakers are common equipment for olive harvesting. Not surprising information concerning their performance is available.
For less usual equipment like canopy shakers, however, there is lack of information relative to their field work.
This paper deals with the performance of an "Oli-picker" harvester which is basically a rotor device brushing the canopy, mounted on a structure making possible it to work anywhere, inside or around the olive tree crown, detaching olives.
This paper presents results from two years of observation in olive orchards of Trás-os-Montes (northeast of Portugal), including the methodologies of work followed in the field and the work rates found.

Key word: *olives mechanical harvesting; spike rotor.*

Introduction

Important research about mechanical harvesting of olives has been carried out in several olive producers' countries, including Portugal. In these studies the fruit detachment is made with trunk (or branch) shakers. This is the equipment usually adopted by framers that have mechanized this operation.
It is not usual to find studies about other equipment designed for olives detachment that work directly the tree canopy. The equipment commercially known as "Oli-Picker" has a spike rotor with a rotation movement, brushing inside or around de tree canopy detaching the olives.
In 2005 started the record of information about this equipment performance. Preliminary results of two harvesting seasons (2005/2006 and 2006/2007) are presented.

Material and methods

The Oli-Picker detached the fruits. This equipment was mounted in a 59 kW tractor. Has a spike rotor supported by an articulated arm. Main characteristics are in Table 1. The rotor can turn round his axle. The articulated arm allows the rotor to brush the canopy around or inside the tree crown (Figure 1).
The olive groves considered in the two years of observations have three main cultivars: Verdeal Transmontana, Cobrançosa and Madural.

Figure 1: "Oli-Picker harvester at work.

Table 1 – Oli-Picker main caracteristics

Maximum height	8,5 m
Attainment	6,8 m
Total weight	600 kg
Rotor length	1,5 m
Rotor brush pairs	83

First year observations

Three sites have been considered for observations in the first year (2005/2006). Tree canopies of site 1 are smaller than tree canopies of sites 2 and 3. Tree canopies of sites 2 and 3 are similar.

To collect the olives detached it was used the traditional way: 10m X 10 m canvas placed under the canopy projection, moved by 4 labourers. A fifth labourer hit the tree canopy with a wood stick, simultaneously with the "Oil-Picker" work.

The tractor and Oli-Picker stopped in a place (station) in order to detach the fruits of one or two trees. In a few number of stations the equipment could detach the olives of four trees. To complete the fruit detachment of one tree, it was necessary to use more than one station (Figure 2).

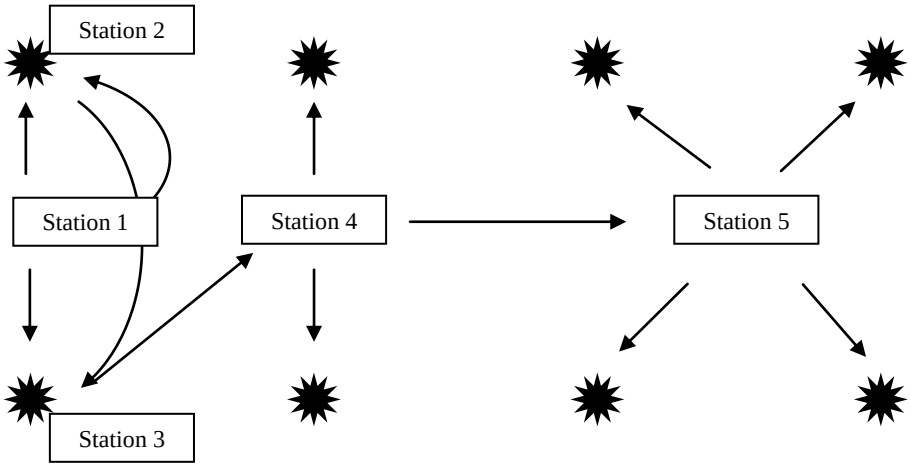

Figure 2:Exemple of places used as stations and equipment trajectories in the first year of observations.

Second year observations

Four sites have been considered for observations in the second year (2006/2007). Canopies are similar in all sites.

In the second year, work methodology was different. Three labourers hit the trees with wood stick and a fourth labourer was operating a mechanical branch shaker (Figure 3).

In each station the Oli-Picker detached partially the fruits of one or two trees, being the detachment of fruits remaining in the trees made by the four labourers, one of them operating the mechanical branch shaker.

So, it was not necessary to use another Oli-Picker station to complete the fruit detachment of each tree (Figure 4), like in the first year observations.

Figure 3: Second year observations - Oli-Picker harvester and a mechanical branch shaker operated by a labourer, working simultaneously.

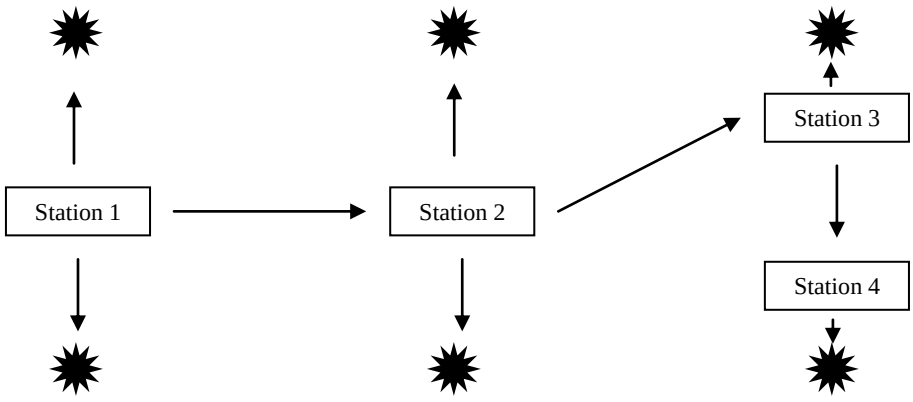

Figure 4:Exemple of places used as stations and equipment trajectories in the second year of observations.

Results

Tables 2 to 4 show the first year of observations results

Table 2 – Data collected in site 1.

Number of trees worked	22
Number of stations	14
Brushing total time (and percentage) rotor/canopy	69,38 minutes (81,34%)
Brushing average time rotor/canopy	2,89 minutes
Detachment average time per tree	3,15 minutes
Total time (and percentage) to move from one station to the next	15,92 minutes (18,66%)
Average time to move from one station to the next	1,59 minutes
Average number of trees brushed per station	1,6
Harvesting total time	85,3 minutes
Work rate	15,5 trees/hour

Table 3 – Data collected in site 2.

Number of trees worked	8
Number of stations	11
Brushing total time (and percentage) rotor/canopy	36,03 minutes (72,96%)
Brushing average time rotor/canopy	2,57 minutes
Detachment average time per tree	4,5 minutes
Total time (and percentage) to move from one station to the next	13,35 minutes (27,04%)
Average time to move from one station to the next	1,48 minutes
Average number of trees brushed per station	0,72
Harvesting total time	49,4 minutes
Work rate	9,7 trees/hour

T*able 4 – Data collected in site 3.*

Number of trees worked	12
Number of stations	17
Brushing total time (and percentage) rotor/canopy	49,71 minutes (76,68%)
Brushing average time rotor/canopy	2,76 minutes
Detachment average time per tree	4,14 minutes
Total time (and percentage) to move from one station to the next	15,12 minutes (23,32%)
Average time to move from one station to the next	0,95 minutes
Average number of trees brushed per station	0,7
Harvesting total time	64,8 minutes
Work rate	11,1 trees/hour

Tables 5 to 8 show the second year of observations results

Table 5 – Data collected in site 4.

Number of trees worked	18
Number of stations	10
Brushing total time (and percentage) rotor/canopy	34,67 minutes (80,35%)
Brushing average time rotor/canopy	1,93 minutes
Detachment average time per tree	1,93 minutes
Total time (and percentage) to move from one station to the next	8,48 minutes (19,65%)
Average time to move from one station to the next	1,06 minutes
Average number of trees brushed per station	1,8
Harvesting total time	43,15 minutes
Work rate	24,2 trees/hour

Table 6 – Data collected in site 5.

Number of trees worked	14
Number of stations	11
Brushing total time (and percentage) rotor/canopy	32,84 minutes (73,25%)
Brushing average time rotor/canopy	2,35 minutes
Detachment average time per tree	2,35 minutes
Total time (and percentage) to move from one station to the next	11,99 minutes (26,75%)
Average time to move from one station to the next	1,20 minutes
Average number of trees brushed per station	1,27
Harvesting total time	44,83 minutes
Work rate	19 trees/hour

Table 7 – Data collected in site 6.

Number of trees worked	23
Number of stations	16
Brushing total time (and percentage) rotor/canopy	57,45minutes (72,76%)
Brushing average time rotor/canopy	2,5 minutes
Detachment average time per tree	2,5 minutes
Total time (and percentage) to move from one station to the next	21,51 minutes (27,24%)
Average time to move from one station to the next	1,43 minutes
Average number of trees brushed per station	1,44
Harvesting total time	78,96 minutes
Work rate	17 trees/hour

Table 8 – Data collected in site 7.

Number of trees worked	24
Number of stations	17
Brushing total time (and percentage) rotor/canopy	58,55 minutes (77,95%)
Brushing average time rotor/canopy	2,44 minutes
Detachment average time per tree	2,44 minutes
Total time (and percentage) to move from one station to the next	16,56 minutes (22,05%)
Average time to move from one station to the next	1,04 minutes
Average number of trees brushed per station	1,4
Harvesting total time	75,11 minutes
Work rate	19 trees/hour

Discussion

First year observations

In the observations made in 2005/2006, site 1 revealed the better work rate – 15,5 trees per hour, and the higher number of trees brushed per station – 1,6. These results are consequence of the smaller tree canopy volume.

Sites 2 and 3, with similar number of trees brushed per station – 0,7 have different work rates. Site 3 have a better work rate – 11,1 trees per hour, because it was necessary less time to move the equipment from one station to the next. This advantage is result of an efficient labour performance to move the canvas from one tree to the next.

Second year observations

The work methodology followed in this year (2006/2007) lead to a better work rates. The combined use of a mechanical branch shaker operated by a labourer, revealed to be efficient in order to improve the performance of this harvesting system. The number of trees brushed per station is between 1 and 2. The two equipment working together reduced the time necessary to detach the olives.

The tree canopy volume in these 4 sites is similar. The time spent to move from one station to the next assumes a great influence in the work rates values.

The more usually mechanical trunk shakers harvesting systems have in average work rates between 50 to 80 trees shacked per hour (Almeida, 1999 and Peça, 2002), much better then the presented for the Oli-Picker.

However it is necessary to emphasize two differences that can show the Oli-Piker rotor interest:

1- The olives detachment in trees with a big canopy (usually old trees with a good olive production) is more efficient with the spike rotor, than with trunk shakers (Figure 5).

2- The spike rotor can detach 100% of the olive production. Trunk shakers usually detach 80% to 90% of the olives produced (Michelakis, 2002).

Figure 5: In a big olive tree the rotor detach the fruits more eficiently than the trunk shaker.

References

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