MECHANICAL OLIVE HARVESTING SYSTEMS

Arlindo Almeida,
Escola Superior Agrária
de Braganca, Braganca -
Portugal

Bento A. Dias, Oliveira
J. Peca and A. Pinheiro
Universidade de Evora,
Evora. – Portugal

Luis S. Santos
Departamento de
Olivicultura da
E.N.F.V.N., Elvas.-
Portugal

Sousa D. Reynolds
R&O, Monte da Granja,
Estremoz.- Portugal

Joao Lopes
Dir. Regional de
Agricultura de Trás-os-
Montes, Mirandela.-
Portugal

Keywords: Olives mechanical harvesting/three collecting systems.

Abstract

Trunk or bough shakers for the mechanical harvesting of olives can be complemented by collecting equipment now available: the inverted umbrella and the rolling canvas catching frame. The performance of both is compared with the traditional method of collecting olives on a canvas layed manually under the tree, the fruit being detached by shakers. Work rates and costs are compared under field trials in Portugal (Alentejo and Trás-os-Montes regions).

1. Introduction

Olive growing is a traditionally labour intensive activity in Southern European countries. High costs, particularly at harvesting and pruning are increasingly justifying mechanization. Tree shakers are now widely accepted among larger growers. The harvesting process can be complemented by collecting equipment like the inverted umbrella and the rolling canvas catching frame. However, technical and commercial knowledge about this equipment is lacking, especially in the conditions found in Portuguese agriculture.

The inverted umbrella and the rolling canvas catching frame are compared in field trials with the common method of collecting olives on a canvas layed manually under the tree, the fruit being detached by the same shaker.

2. Material and methods

2.1. Olive orchards

Field trials took place in the two main regions of olive production in Portugal: Alentejo and Trás-os-Montes.

Site 1 - Monte da Revenduda, Sousel, Alentejo: a 30 year old olive orchard of the local variety Galega, established largely on 20% slopes, with an array of 100 trees per hectare. Tree crowns are between 38 m^3 and 70 m^3. Traditional pruning over the last few years has promoted an excess of wood. A sample of 416 trees was used in the trials.

Site 2 - Monte da Granja, Estremoz, Alentejo: a 70 years old olive orchard of the local variety Galega, established on flat land, with an array of 100 trees per hectare. Tree crowns are between 31 m^3 and 79 m^3. As in site 1, traditional pruning has promoted an excess of wood. A sample of 478 trees was used in the trials.

Site 3 - Sucaes, Mirandela, Tras-os-Montes: a 35 year old olive orchard of the local variety Verdeal, established on 10% slopes, with an array of 200 trees per hectare. Tree

Proc. 3rd Int. ISHS Symp. on Olive Growing
Eds. I.T. Metzidakis and D.G. Voyiatzis
Acta Hort. 474, ISHS 1999.

crowns are between 23 m^3 and 62 m^3. Pruning was considered appropriate for mechanical harvesting. A sample of 241 trees was used in the trials.

2.2. Harvesting systems

Chain A: Tractor with a front mounted tree shaker + tractor driver; 8 labourers to move the canvas under the trees; tractor and trailer + tractor driver, for transport.

Chain B: Tractor with a front mounted tree shaker + tractor driver; tractor with a side mounted rolling canvas catching frame and trailer + tractor driver; 2 labourers.

Chain C: Tractor with a front mounted tree shaker and an inverted umbrella combination + tractor driver; tractor with a trailer + tractor driver, for transport.

The diameter of the inverted umbrella was 9 m. The total area of canvas in the rolling canvas catching frame was 64 m^2, being made by two 4 m x 8 m separate parts, layed down on either side of the tree. The canvas moved by the labourers was approximately 100 m^2.

2.3. Experimental design

The experimental design was a randomized complete block with three treatments (chain A; B and C) and three replications. Each block was subdivided into three equal-sized plots of 30 trees each. The mass of the olives harvested by the shaker was measured. The mass of olives remaining on the trees was evaluated by manual picking from a sample of trees selected by randomization.

2.4. Cost analysis

The following assumptions were made to compute costs: 50 days maximum per harvesting season; 6,5 available hours per day; local values for labour wages; ownership and operating costs for machinery other than shaker and collecting equipment, based on official tables for all-year-round used equipment; the costs relative to the shaker, inverted umbrella and rolling canvas catching frame was computed from information collected from the manufacturer, since no official data is available. Depreciation of this equipment was assumed to be over a period of 8 to 14 years, depending on the annual use.

3. Results and discussion

Results are presented in figures1 to 7.

The principle behind mechanization is to counterbalance the higher capital investment by faster work rates. From Figures 2 to 4, it can be read that work rates are the same or even inferior when the labour force is replaced by machinery. As a result, costs per tree are still very competitive in chain A, as revealed by figures 5 to 7.

With fewer labour available in agriculture it is important to equate, in terms of costs, the inevitable step towards mechanization.

The equipment proposed in chain B and C can be an interesting alternative to farmers, provided costs can be reduced by the increment of work rates.

Tractor stability on slopes and general safety rules should always be regarded as the priority factor assisting decisions on machinery selection and on laying out field operations. The following factors revealed in the field trials, may also contribute to faster work rates:

— provide adequate training for operators;
— free orchards of any removable obstacles;
— improve front visibility of tractor - shaker - inverted umbrella combination;
— improve coordination between tractors in chain B in order to reduce time.

Acknowledgements

The authors wish to thank the olives growers for their collaboration and the research programme PAMAF for the financial support.

References

Ramalho, J.S.R. *et al.* Alguns Ensaios de Colheita Mecânica de Azeitona no Baixo Alentejo, I.N.I.A., 63 - 68.

Santos L. *et al.* 1989. Mecanização da Colheita de Azeitona, Tecnologias Agrárias, Outubro: 38 - 42.

Santos L. 1984, Alguns Dados Sobre a Mecanização da Colheita de Azeitona, Ovibeja I.N.I.A.: 1 - 11.

Tombesi, A. 1990. Physiological and Mechanical Advances in Olive Harvesting, Acta Horticulturae, 286: 399 - 412.

Tsatsarelis, C.A. *et al.* 1984. Classification of Olive Varieties for Effective Mechanical Harvesting, Transactions of ASAE: 1669 - 1673.

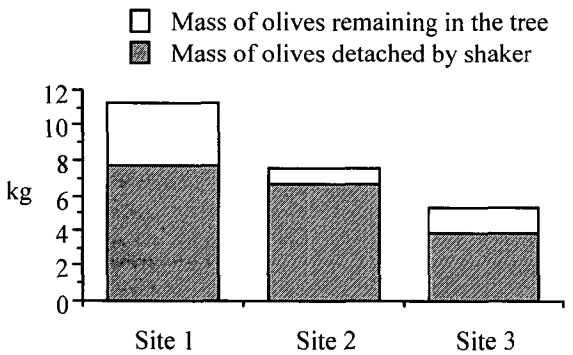

Figure 1. Yield per tree.

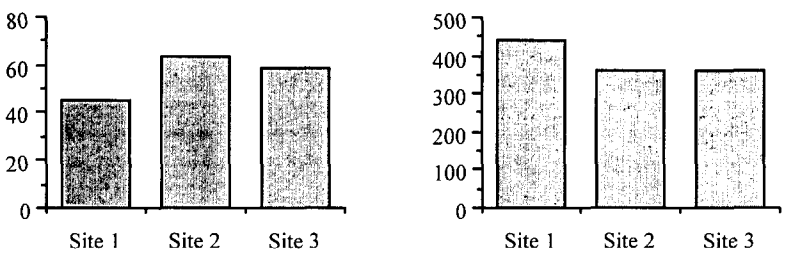

Figure 2. Chain A: work rates in trees per hour and kg of olives harvested per hour.

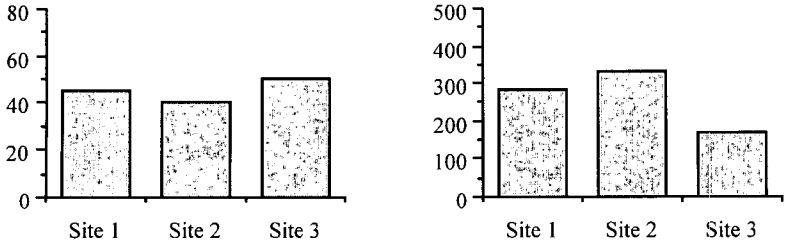

Figure 3. Chain B: work rates in trees per hour and kg of olives harvested per hour.

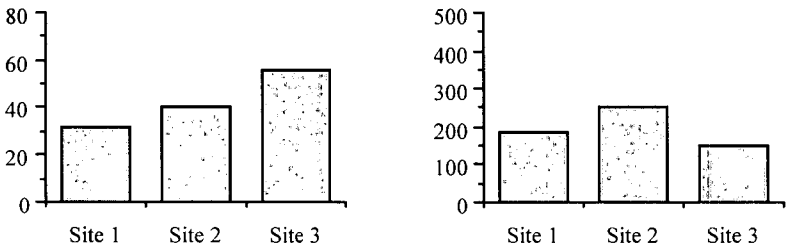

Figure 4. Chain C: work rates in trees per hour and kg of olives harvested per hour.

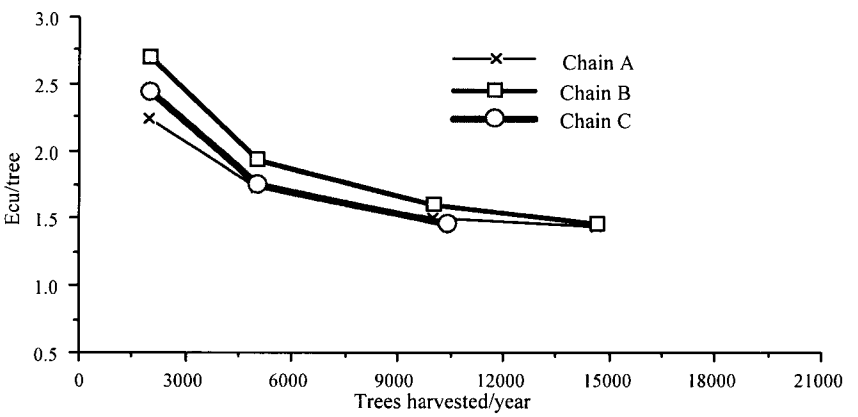

Figure 5. Site 1: cost/tree.

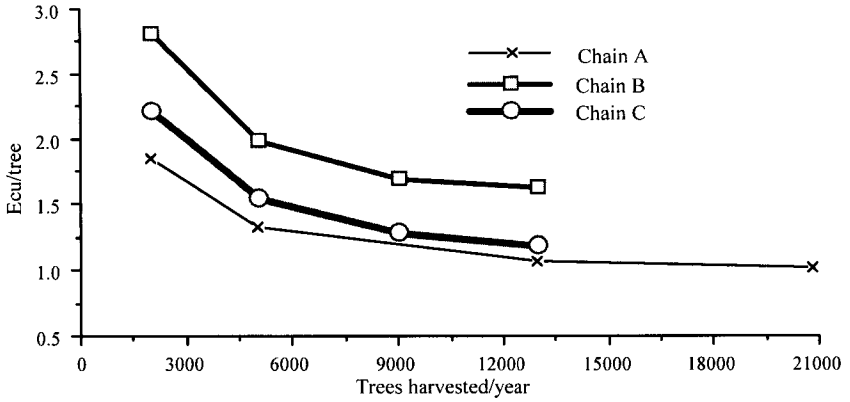

Figure 6. Site 2: cost/tree.

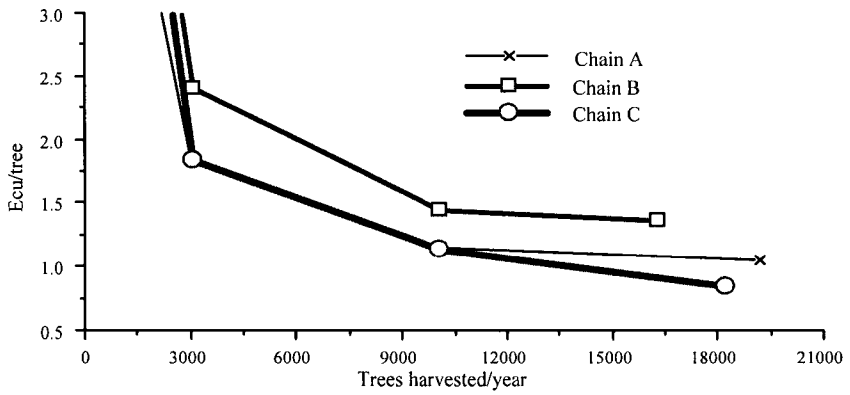

Figure 7. Site 3: cost/tree.