

Strategies to Reduce Mechanical Harvesting Costs in Traditional Olive Orchards



Arlindo Almeida^{a,*}, Anabela Fernandes-Silva^b

^a Centro de Investigação de Montanha (CIMO), Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal

^b Centre for Research and Technology of Agro-Environment and Biological Sciences; University of Trás-os-Montes e Alto Douro, Quinta dos Prados, 5000-801 Vila Real, Portugal

* Corresponding author. Email: acfa@ipb.pt

The problem

In Mediterranean basin, traditional olive orchards have an important economic value. In this type of olive orchards planting densities are 100 to 240 trees per hectare, and over 30 years old.

In these olive orchards, the most used mechanical harvesting system is based on a trunk shaker to detach fruits, and an inverted umbrella to collect them.

With this harvesting system it is usual to collect 70% to 90% of the production.

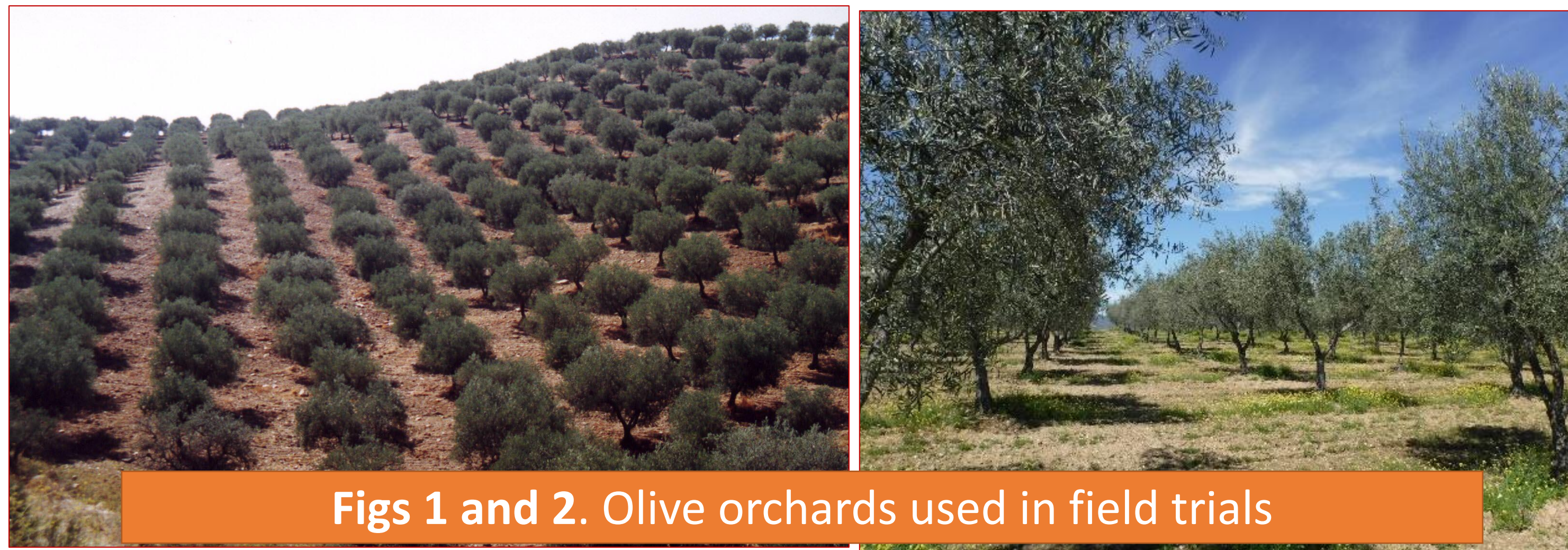
The olives that remain in the tree is a problem. To solve it, farmers adopt manual harvesting as a complementary task.

This procedure increases the cost of harvesting with the addition of labour and reduces the mechanical harvesting system work rate (trees hour⁻¹).

It is important to assess if olives manual removal remaining on the tree after the trunk shaker work has a compensatory cost.

However, this does not seem to be the case, given the results presented.

Complementary manual harvesting may be a solution, but an evaluation of other agronomic and mechanical solutions is recommended.



Material and methods

In field tests were carried out in the Northeast of Portugal for three years on traditional olive orchards with "Cobrançosa" and "Verdeal Transmontana", cultivars two different procedures were compared: (I) mechanical harvest performance complemented by manual harvesting; (II) mechanical harvest performance without the addition of manual work.

In both procedures were evaluated: a) work rate (trees hour⁻¹); b) production harvested; b) associated costs; c) harvest efficiency considering it as the percentage of fruits collected in relation to total production.

To evaluate work rate system, a methodology based on measurement of each elementary operation time (in minutes) was adopted.

Costs was computed under international standards for agricultural machinery management.

Results

Table 1. Olive orchards with manual complementary harvesting the maximum and minimum values are marked.

Orchard	Total production (kg)	kg tree ⁻¹	Work rate (tree hour ⁻¹)	Minutes tree ⁻¹	Estimated work rate without manual harvesting (trees hour ⁻¹)
L1AR1	1511	30.2	33.10	1.81	52.41
L1AR2	1215	21.7	37.94	1.58	50.68
L1AR3	2143	33.5	34.36	1.75	46.34
L2AR1	905	18.1	15.22	3.94	20.70
L2AR2	638	10.6	22.72	2.64	29.22
L3R1	920	17.4	14.27	4.20	17.55
L3R2	750	14.2	10.96	5.47	13.63
Average		20.81	24.08	3.06	32.93

Table 2. Olive orchards with manual complementary harvesting the maximum and minimum values are marked.

Orchard	Production by manual harvesting (kg)	Harvesting efficiency (%)	Costs kg ⁻¹ of total harvested production, (€)	Estimated costs kg ⁻¹ without manual harvesting (€)	Costs kg ⁻¹ of production harvested by manual harvesting (€)
L1AR1	82.5	94.5	0.07	0.05	0.52
L1AR2	58.24	95.2	0.07	0.07	0.07
L1AR3	65.92	96.9	0.06	0.05	0.45
L2AR1	130	85.6	0.17	0.14	0.66
L2AR2	100.8	84.2	0.23	0.22	0.76
Average		91.28	0.12	0.11	0.49

Table 3. Olive orchards without complementary harvesting the maximum and minimum values are marked.

Orchard	Production harvested (kg)	kg tree ⁻¹	Harvesting efficiency (%)	Work rate (tree hour ⁻¹)	Minutes tree ⁻¹	Cost kg ⁻¹ harvested production (€)
L1BR1	910	19	94.0	47.38	1.27	0.08
L1BR2	720	13	96.9	49.76	1.21	0.12
L1BR3	890	15	100	68.34	0.88	0.07
L2BR1	1184	24	100	42.39	1.42	0.07
L2BR2	2994	49	100	32.84	1.83	0.05
L3R3	584	17.7	100	24.57	2.44	0.08
L4R1	703	20.7	91.1	63.46	0.95	0.05
L4R2	725	17.7	95.0	67.12	0.89	0.06
Average		2.01	97.13	49.48	1.36	0.07

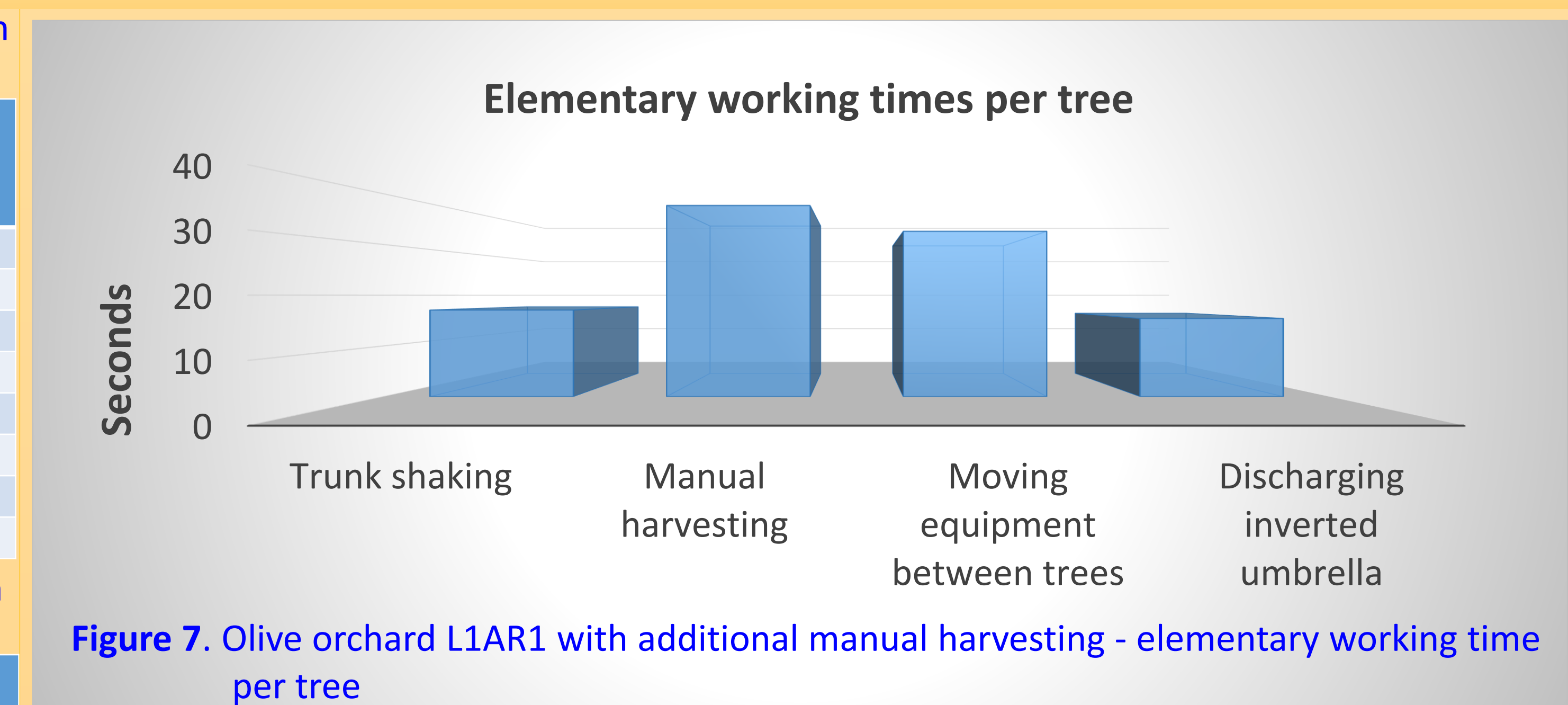


Figure 7. Olive orchard L1AR1 with additional manual harvesting - elementary working time per tree

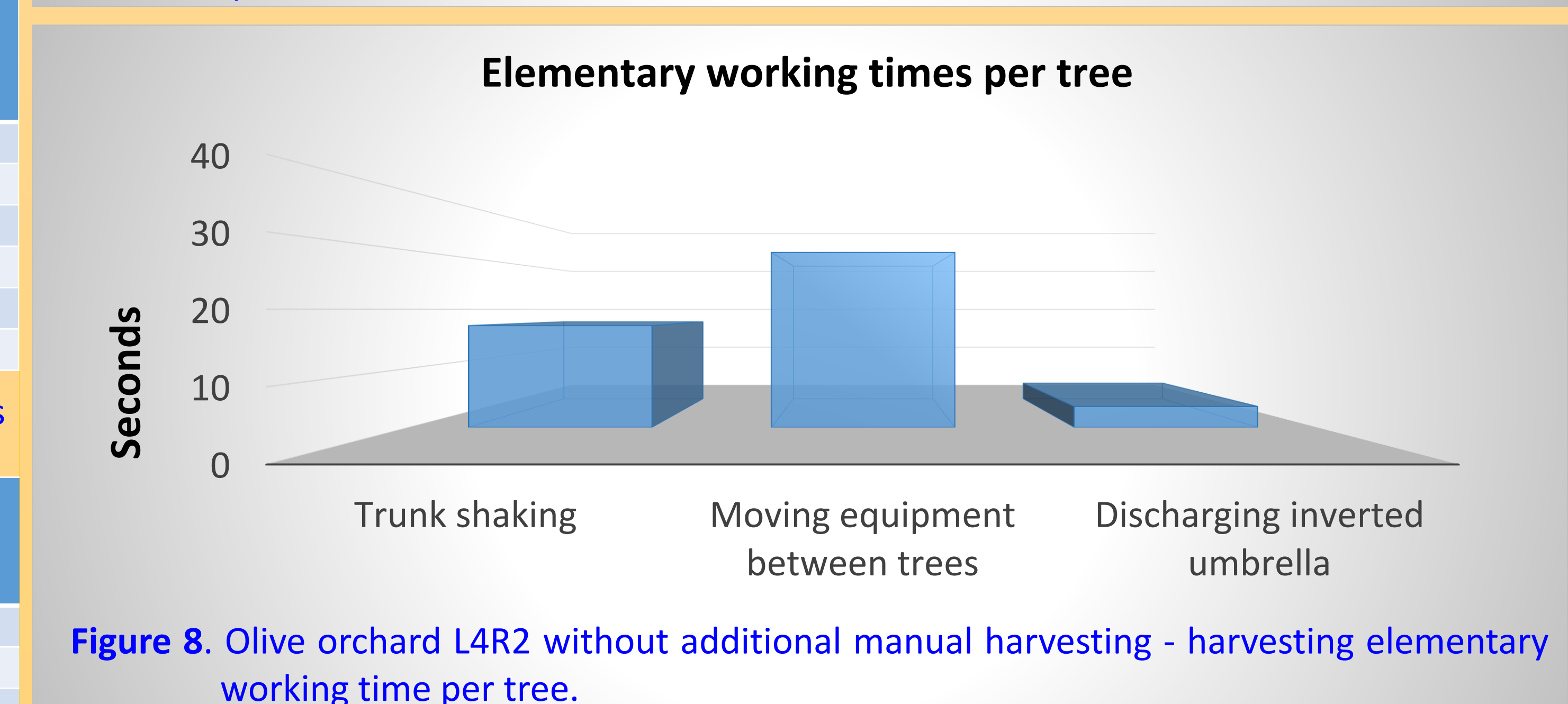


Figure 8. Olive orchard L4R2 without additional manual harvesting - harvesting elementary working time per tree.

Discussion and Conclusions

The reduction in work rate and the increase in harvesting costs with complementary harvesting can be balanced by the increase in production harvested in this way. However, this does not seem to be the case, given the results presented.

The results show that the increase in harvest is reduced and the price per kg of this increase in harvested production is much higher than the commercial value of the olives. Before making the decision to use complementary harvesting, it is important to assess if it is really need, for instance, what harvesting efficiency is expected. With the values obtained in the field tests presented, it may have led to an increase in harvesting costs, without the corresponding return.

Being expected a harvesting efficiency lower than the reference values, complementary manual harvesting can be a solution, but an evaluation of the other agronomic and mechanical solutions mentioned is recommended.