Machines for Canopy Restraining in the Super Intensive Olive Growing [1]

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Abstract
This paper concerns long-term observations regarding the mechanization of the operation of the canopy restraining carried out on some super intensive olive groves of unlike age and different varieties (FS17, Arbequina, Arbosana), in order to supply an up-to-date information of the solutions adopted in Apulia.
According to the surveys executed in the tested super intensive olive groves, the mechanical restraining of the canopy has to be made as from the 4th year from the planting. The practicability of the different interventions through machines results different, in relation to: a) the particular carried out operation, b) the frequency of execution during the years, c) the consequent agronomic spin off.

Keyword: super intensive olive growing, mechanization, pruning

Introduction

The super intensive olive growing mechanization does not concern just the harvesting but above all the pruning and, in more general terms, the canopy restraining during the years until reaching the moment of the plant replacement. The costs of such operations, according to some experiences conducted in Spain, can represent up to 70% of the total cost of the ordinary management of the olive grove.
This paper concerns long-term observations regarding the mechanization of the operation of the canopy restraining carried out in some super intensive olive groves of unlike age and different varieties (FS17, Arbequina, Arbosana), in order to supply an up-to-date information of the solutions adopted in Apulia.
The problems concerning the mechanization of the pruning interventions arise from the necessity to harmonize two conflicting requirements: respect for the productive branches and, at the same time, the restraining of the section of the canopy, crosswise to the direction of the row, within compatible limits (height, thickness, form) with the sizes of the tunnels of harvest. These vary in the different harvesting machines, and for each one, with the adjustments.
The pruning interventions, carried out mechanically (topping, hedging and at the bottom of the canopy) and manually (up to the 3th year from the planting) for the cutting of the branches placed below of the olives intercepting members (scales, buckets) of the straddle harvesters, still pay for a set of unreliability concerning the manner and the frequency of execution, in relation to: a) the age of the plant; b) the behavior of the variety; c) the cultivation techniques; d) the areale of cultivation.
The mechanization of some of such interventions (topping, hedging) are made with machines risen from the disk pruners for a time employed in traditional fruit and olive growing (Fontanazza *et al.*, 1998; Napoliello, 2000; Pascuzzi *et al.*, 2007; Tombesi *et al.*, 2007; Vega, 2004).

[1] *Each of the authors contributed in equal parts to this work.*

Materials and Methods

Technical solutions, craft made some of these, have been experimented for interventions of topping and cuts of raising of the bottom of the canopy (Figure 1). The tests have been carried out with a machine risen from the disk pruners for a time employed in traditional fruit and olive growing: «BMV» with 5 disk mounted on the straddle tractor «BRAUD» SB56.

Figure 1. Pruners employed for interventions of topping at height 2,20 m from the ground in an olive grove of the FS 17 variety (7th year from the planting) : [A]- pruner rised by «BMV» with 5 disk; [B] straddle tractor «BRAUD» SB56; [C] mowing bar; [D] mowing bar mounted on the tractor.

The surveys have concerned the evaluation of: a) the number of the pruning interventions, b) the operative velocities, c) the time of work/hectare.
The finishing touch has been carried out by means manual shears on the sides of the row; then the single side delivery raking has been made. Finally, the shredding pruning waste has been executed by means the shredder «FACMA» TR180PE (Fig. 2).

Results and discussion

The interventions of topping in olive groves of different variety and age have obviously required very different operational velocities (from 0,2 to 3 km/h) and therefore times of work/hectare.

For the variety Arbosana, four years old, requiring, on average, four interventions of pruning for plant on branches having, almost all, diameter lower than 15 mm (Figure 3A), it has been enough more than 1 h-machine/ha, against the 23 h-machine/ha of the FS17, necessary (Table 1) to carry out on average 26 interventions of pruning for plant on branches having for 50% caliber higher than 15 mm (Figure 3B).
The subsequent operations, when expected: a) bottom lopping and manual finishing touch of the canopy, b) single side delivery raking, c) shredding pruning waste, have required unit employments of machines and manpower increasing with the age of the olive-groves.
Particularly: interventions concerning the restraining of the canopy have been not executed till 3 years from the planting; the cutting off the trunk of the branches placed further down has been made only at the 3th year from the planting; the intervention of topping has been necessary since the 4th year on, followed by the manual finishing touch of the canopy on the two sides of the row and from the mechanical shredding of the pruning waste.

Figure 2. Subsequent interventions of the mechanical top and bottom (of the canopy) lopping: [A] shortening or removal of the protruding branches in the inter-row, [B] cleaning of the under-canopy by the pruning waste, [C] single side delivery raking, [D] shredding.

The highest employments of machines and manpower, respectively lower than 25 h-machine/ha and 50 h-worker/ha have been reported in the seven years old super-intensive olive-grove of the variety FS17 for the operations: harvesting, canopy restraining and pruning waste. But here there are been the first serious problems with regard to the canopy restraining within sizes compatible with those of the tunnel of the harvester, to the point that to suggest a drastic reduction of the canopy to the wooden axis only. This has shown that the problems

arise to impose the super intensive model of olive growing itself – over the reflections owing to the inexperience – are to investigate mostly from the agronomic side rather than the so called economic one.

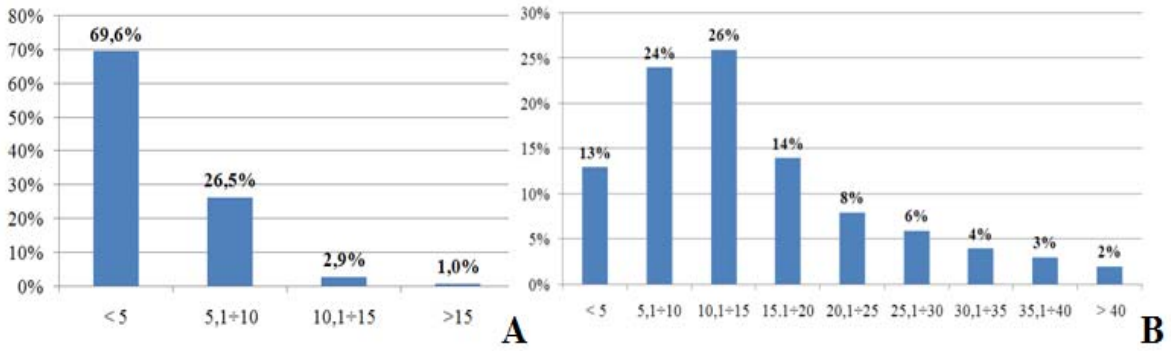

Figure 3. Average percentage values of the cutting number, by dimensional class partition, recorded during the last mechanical pruning intervention (topping) carried out in super intensive olive groves of the variety : A – Arbosana, B – FS17.

Table 1. Unit employments of machines and manpower.

Cultivar	FS17		Arbosana		Arbequina	
	A[(1)]	B[(1)]	A	B	A	B
harvesting[(2)]	6,1	12,2	2,8	5,6	1,4	2,8
topping	10,1	10,1	1,0	1,0	/	/
lopping of canopy bottom	3,1	3,1	/	/	/	9,6[(3)]
manual finishing touch and single side delivery raking of the branches	/	14,7	/	10,9	/	/
shredding of the branches	3,7	3,7	1,3	1,3	/	/
total	23,0	43,8	5,1	18,8	1,4	12,4
years from the planting	7		4		3	

(1) A : h-machine/ha B : h-worker/ha

(2) The unit employments are reported to the total time of work, including also the times of turning and maneuvering, of unloading of the picked product and possible cleaning of the tunnel of harvest with removal of the broken branches during the operation (variety FS17).

(3) A manual intervention of removal of branches placed at the base of the trunk was needed ever since 3 years from the planting.

Conclusions

According to the surveys executed in the tested super intensive olive groves, the mechanical restraining of the canopy has to be made as from the 4th year from the planting. The practicability of the different interventions through machines results different, in relation to: a) the particular carried out operation, b) the frequency of execution during the years, c) the consequent agronomic spin off.

The operations of topping, of raising of the bottom of the canopy and field shredding of the pruning waste, have not caused problems of particular importance, from the point of view of

the employed machines. The greatest doubts have concerned, instead, the mechanization of the operations of hedging.
As a subsequent, even if swift, intervention of manual finishing touch on the sides of the row is anyhow necessary, the choice of some olive growers to totally exclude the employment of machines, for the execution of the operation, is justified.

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