

Overview of “ALT'CARPO” concept and its development in France

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Abstract

Natural insecticides against some fruit pests (such as codling moth or fruit flies) have been disappointing these last years, and no significant improvement has been achieved with plant protection products. Therefore, mechanical protection with plastic nets (already widely used in Israel) has been developed with success in France under extreme pest pressure.

Results on codling moth since 2005, and on cherry fruit fly or other pests since 2008 are very interesting, and even motivate conventional growers to convert some orchards to organic farming. Side effects on trees, diseases, and beneficial insects are also assessed. This paper is more an overview of various experiences than a research report.

Keywords: codling moth, net, physical control, Alt'Carpo

Introduction

Codling moth remains the most damaging pest on apples in southern France (Sauphanor, 2007). The “Alt'carpo” concept³ was tested for the first time in France in 2005, then validated on 9 commercial orchards in 2006. In 2007, it was set up to assess the performance of this method for the first year of development in commercial orchards, and answer specific questions: behaviour of codling moth (CM) under nets, influence of the nets closing date and the dama-ges caused, as well as the importance of the size of the net's mesh (Severac *et al.*, 2008). During following years (2008-2009), development in organic and integrated or-chards has been significant, and other fruit species have also been investigated.



Figure 1: Different kinds of nets installed in apple orchards

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Material and Methods

In 2007, about 30 hectares of apple orchards in southern France were already protected with nets. Most of those covered orchards, conducted in organic (2/3) and integrated (1/3), showed some important CM damages the previous year (between 3 and 40% according to plots).

For the trials shown below, observations were made at the end of every CM generation, as well as at picking time, on 1000 fruits per treatment, randomly chosen.

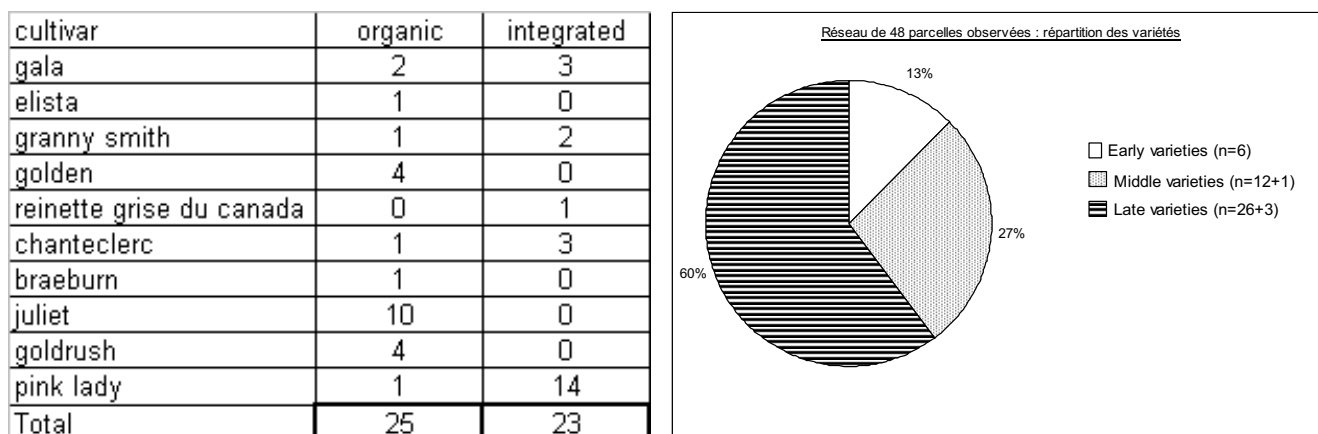


Figure 2: example of orchards and cultivars observed in 2008

1) Efficacy on codling moth

Protection by the « Alt'carpo », was compared to a classical grower's plant protection programme:

- GV + Bt every 8 days, for organic orchards,
- Synthetic insecticides every 10 days, for conventional ones.

The net was the only protection against CM; however, in case of a late set up of the net, some producers used GV at the beginning of season.

No untreated plot could be associated to the trial, because of a high level of CM risk. The counting of all the covered orchards (around 3000 m² each) at the end of each generation of CM was done.

2) Influence of the net's set up date

The closing of nets was generally done around April 20th, just before first egg layings. For technical reasons, some nets have been set up after this date, and one treatment with granulosis virus (GV) had to be applied just before.

The orchards were protected with "Alt'carpo" (only protection against CM) ; 3 orchards have been observed, per date :

- *date 1*: nets set up at the right time.
- *date 2* : nets set up the month following the right date, with an additional GV treatment.
- *date 3*: nets set up more than a month after the right date, with one or two additional GV treatments.

3) Influence of the mesh

Two different meshes were compared on apple and cherry orchard: a mesh of 2,2 x 5,4 mm and a mesh of 3 x 7,4 mm (traditional hail net).

4) Influence on other pests and beneficials

Nets have been installed on olive, cherry, peach orchards by different researchers to assess a wider interest in integrated fruit production.

INRA has evaluated the impact of nets on various predators or parasitoids found under the nets. 50 branches infested with *Dysaphis plantaginea* have been checked every week between April and July 2008.

Results

1) Efficacy

We compared the protection with simple nets to growers' protection strategies:

MD: mating disruption; GV: granulosis virus. Evaluation led to the conclusion that nets provide a much better protection against CM damages than treatments in organic.

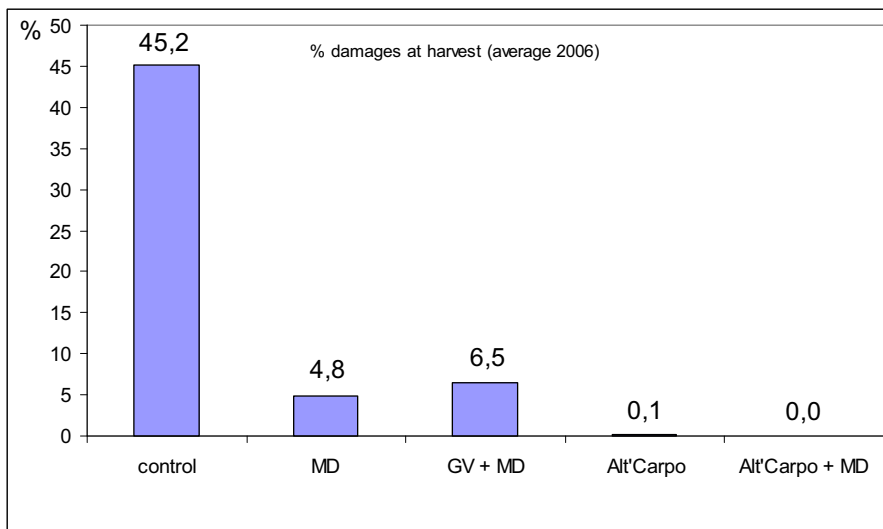


Figure 3: comparison of efficacies for different CM protection strategies

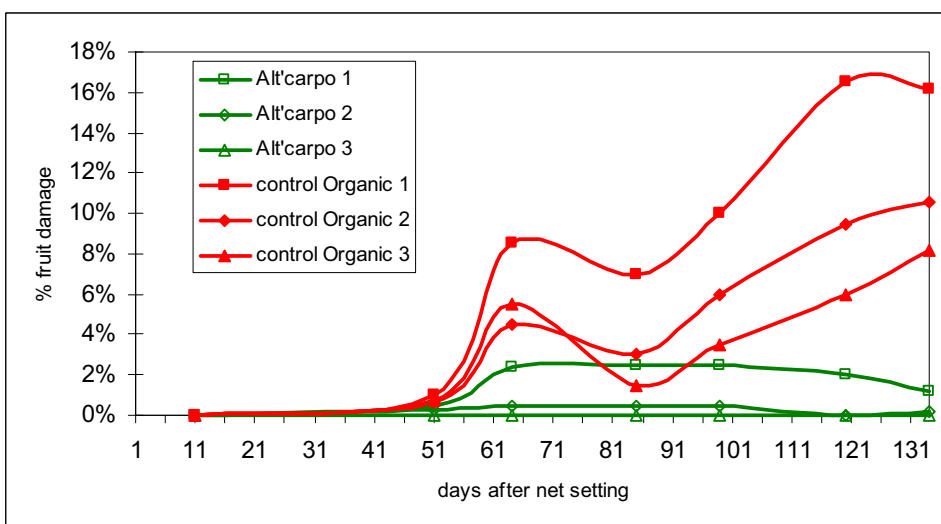


Figure 4: evolution of CM damage under two protection strategies

The development of the technique in 2009 allowed a global overview of the method suitability on 41 different apple orchards. Figure 5 shows that only 12% of these orchards had damages at harvest, but for less than 0.5% of the fruits.

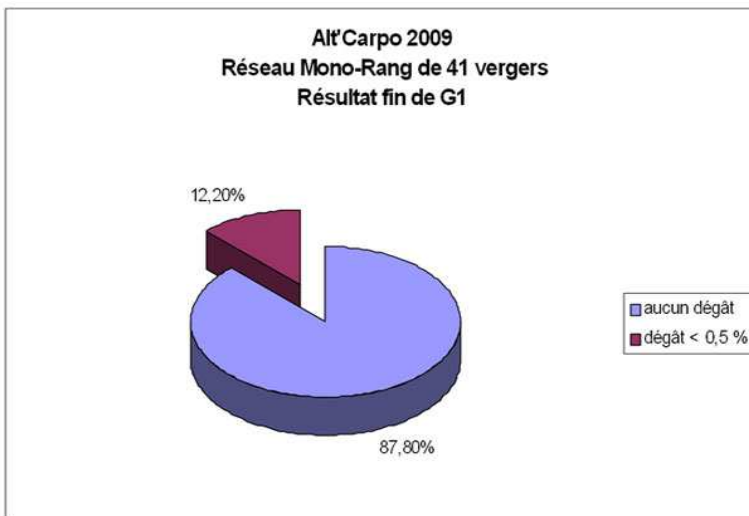


Figure 5: efficacy of protection for 41 different orchards protected in 2009

2) Influence of net's set up date

It seems like GV treatments shall be done in any case, if nets are set up at the right time, or later (for thinning reasons for example). Light damages can be observed at the end of first generation, but bites are generally getting dry and negligible.

Proportion of bites is proportional to the time needed to set up the net. At the end of Generation 1, no new bites have appeared. At the end of G2 and G3, only old and dry bites could be found.

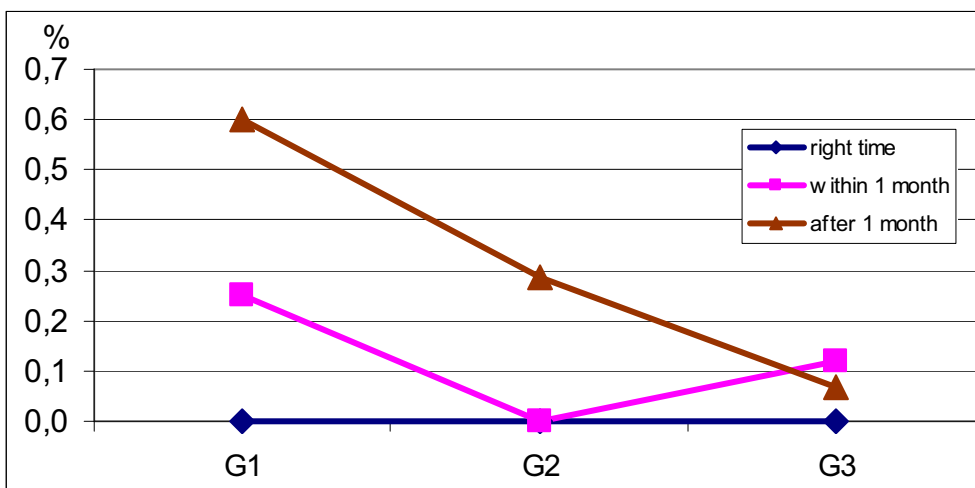


Figure 6: influence of set up date on CM damages under net

3) Influence of the mesh

No difference was found in 2006 between both meshes. In 2007, a trial on a big plot was carried out, on Granny Smith, with a high 2006 pressure (40%) and a low 2007 bearing.

Hail net (with bigger mesh) seemed to compress trees under, and possibly led to more egg layings through the net. Its efficacy was therefore lower, with regular damages throughout the season, on fruits in direct touch with the net, or with neighbouring leaves touching the net.

Results obtained (figure 7) with hail net remain very satisfying with 2% of damaged fruits at harvest, but this result is still below the optimum. The fruits protected by the smaller mesh suffered from no CM damages.

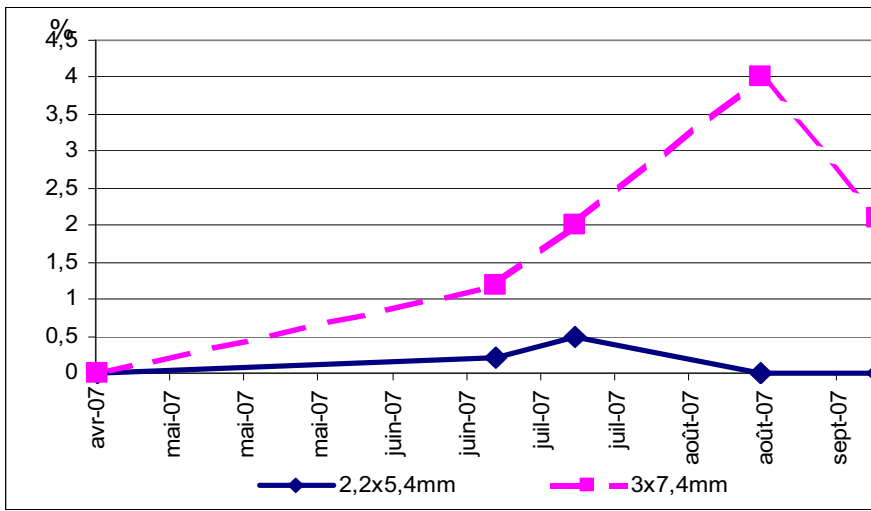


Figure 7: CM damages at harvest with two different meshes

4) Influence on other pests and beneficial insects

Trials have also been conducted on cherry fruit fly, oriental fruit moth, and pear psylla on commercial orchards. Results are usually very good, as showed by pictures below.

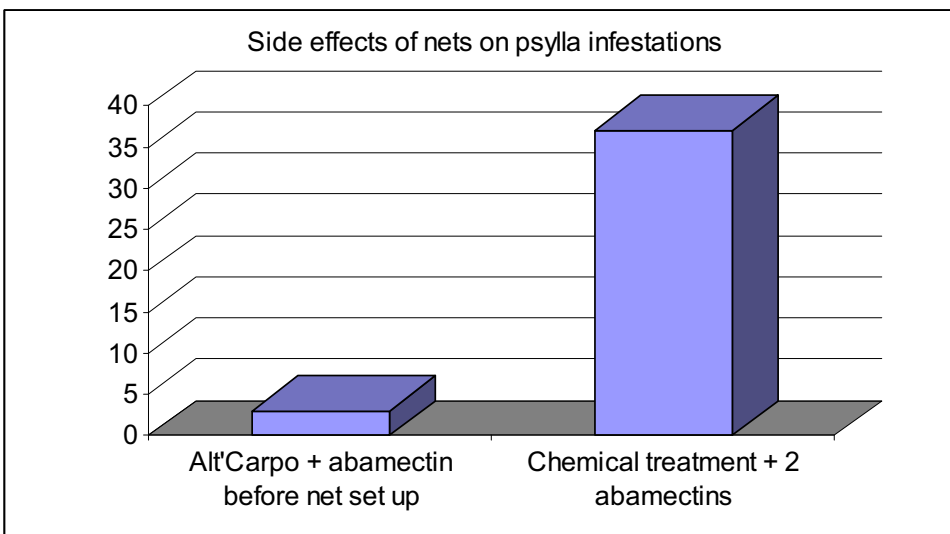


Figure 8: Side-effects of nets on pear psylla populations, compared with insecticide

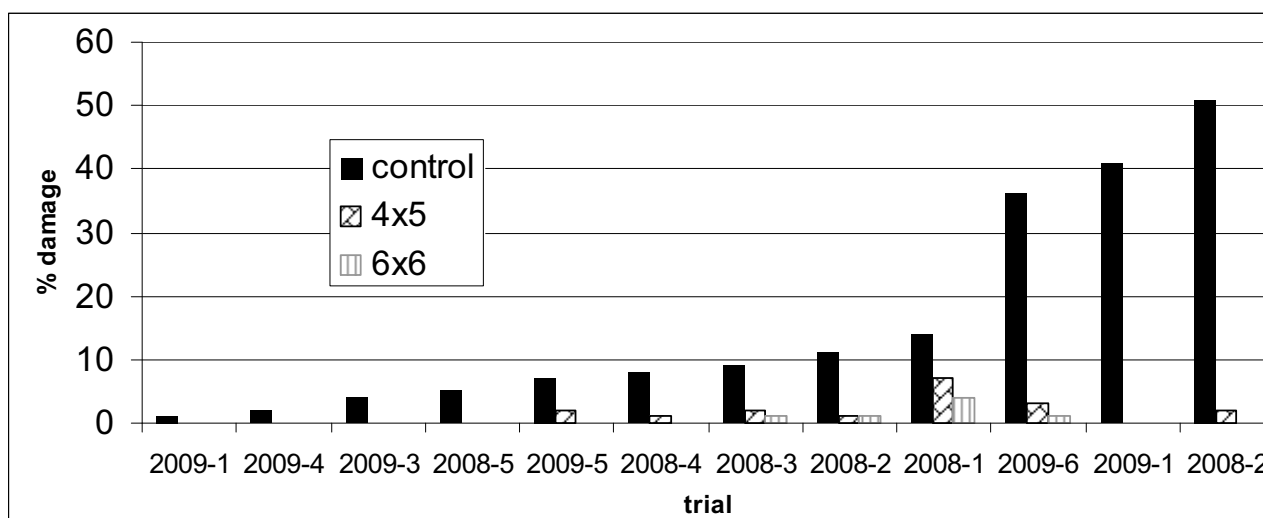


Figure 9: Effect of nets (2 sizes) compared with control on cherry fruit fly damages, on 12 different trials (2008-2009)

Nets have been installed either on each cherry tree, or on a complete row. Efficacy on cherry fruit fly (with the smaller mesh) varies from 80 to 100%. No regular side-effects on moniliosis, cracking or black aphid could be observed so far.

Side effects on different beneficials have been assessed by INRA in 2008, and show different impacts according to communities (data not published).

This study shows a positive impact on earwigs (*Forficula auricularia*) but mostly negative ones, especially on coccinellids or spiders.

Table 1: Total amount of arthropods found between April and July 2008 on 50 branches/orchard

	Integrated orchards		Organic orchards			
	without nets	with nets	INRA	grower1	grower2	grower3
Coleoptera (coccinellids)	217	12	129	139	36	47
Earwigs	84	142	130	82	218	128
Diptera (syrphids)	285	194	116	181	45	45
Heteroptera (myrids)	56	21	8	3		1
Parasitoids	7	3	4	5		
Chrysopids	9	9	5	7	1	
spiders	47	22	14	26	14	19

Discussion

Withdrawal of some insecticides, climate change favouring pests, resistance encountered to more and more molecules (including Granulosis Virus), restricting legislation on treatments and residues, poor efficacy of natural alternatives such as mating disruption, lead to major difficulties for growers.

In such a context, “Alt’carpo” strategy may provide a relevant and successful alternative to fruit growers, as we observed in France for the last 3 years.

Results obtained in commercial orchards on various situations confirm the first preliminary trials carried out since 2005. Investment is justified in southern France with a high pest pressure, and may also be interesting in other places when hail is a threat, as modifications are not very important.

Size of fruits was also observed, with an interesting positive impact of the protection under nets, since first class (> 75mm) rate was improved from 40% to 48%, and third class (< 65mm) rate was reduced from 16% to 6% :

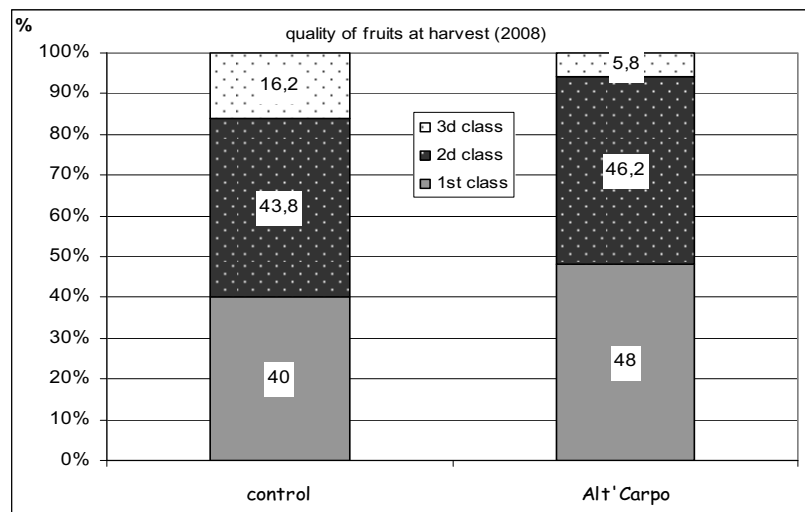


Figure 11: distribution of quality classes for two protection strategies

Costs of different nets and structures are also presented, showing a very interesting return on investment (around 6000 €/ha).

The choice between single row covering or parcel covering is very much depending on many factors, such as size and shape of the plot, cultivation techniques, hail system...

References

Sauphanor B., Berling M, Toubon JF, Reyes M, Delnatte J, Allemoz P. 2006. Carpocapse des pommes : cas de résistance au virus de la granulose en verger biologique. *Phytoma*, 590, 24-27.

List of published papers available on

- <http://www.alt-carpo.com/5.cfm?p=560-protection-carpocapse-protection-pommes-communications-alt-carpo-severac>
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