

Thinning of Organic Apple Production with Potassic Soap and Calcium Polysulfide at the North of Spain.

Enrique Dapena de la Fuente¹ & Alfonso Fernández-Ceballos¹

Abstract

Asturias, in the North West coast of Spain, is a region with old tradition at cultivation of apple and its transformation to cider. The production of apple is mainly done under traditional uses and semi-extensive or semi-intensive system and with local cultivars. Thinning strategy is little practiced and the biennial bearing cycle is one of the main problems for the farmers. The production of apple under organic techniques in Asturias is still limited but increasing. Since 2005, experiments have been conducted on several cultivars ('Raxao', 'Xuanina' and 'Gold-Rush') to evaluate the effects of Potassic Soap (with or without olive oil) and Calcium Polysulfide as thinning products. We present here the first promising results of these experiments. With different concentrations of both products we have increased the apple production of two cultivars for the period 2006-2007. There were positive effects on the vegetative growth of the trees and on the quality of apples. In the spring 2007 we initiated new experiments with other cultivars ('Durona de Tresali', 'Solarina', 'Raxao', 'Regona') in order to confirm our results. The new experiments also include the comparison of their effects with those of commonly used chemical products and with those of manual thinning techniques.

Keywords: apple, thinning, potassic soap, calcium polysulfide.

Introduction

Asturias, in the North West coast of Spain, is a region with old tradition at cultivation of apple and its transformation to cider. Local cultivars are mainly managed under traditional uses and semi-intensive production system and usually no thinning strategy is practiced. Apple production under organic techniques in Asturias is still limited but increasing.

Main goals of thinning alternate-bearing cider apple trees are to increase the production at the 'off year' and to increase fruit quality at the 'on year'. Fruit size and color are not as important as it happens with fresh apple. Thinning methods are applied at spring of the 'on year' in order to reduce the production that year, and increase the production of next year ('off year'). In conventional agriculture chemically synthesized products are used (Dennis, 2000). These products are not allowed in organic production and farmers usually apply hand-thinning, a high cost technique (Dennis, 2002). Since the last years of the 90's a set of experiments have been done to screen different products for the regulation of production in organic agriculture (see a.e Kelderer *et al.*, 1995, 2002; McArtney *et al.*, 2000; Pfeiffer & Ruess, 2002; Warlop & Libourel, 2002; Weibel *et al.*, 2006). In Spain, best results were reached with Potassic Soap and Calcium Polysulfide (Carbó, 2002; Dapena *et al.* unpublished).

After some preliminary trials, in 2006 we carried out a set of experiments with the main objective of evaluating the effectiveness of Potassic Soap (with or without olive oil) and Calcium Polysulfide as thinning products. In 2007 new trials were initiated to evaluate the effectiveness of these products on different local cultivars and compare their effects with those of hand-thinning techniques and with those of commonly used chemicals products.

¹ Programa de Fruticultura. Servicio Regional de Investigación y Desarrollo Agroalimentario (SERIDA). Apdo 13. 33300. Villaviciosa. Asturias. Spain. E-mail: edapena@serida.org

Material and Methods

Trials initiated at year 2006 were conducted on 4-year-old 'GoldRush' and 10-year-old 'Xuanina' trees. Trials initiated at year 2007 were conducted on 4-year-old 'Raxao' and 'Regona' trees and on 12-year-old 'Durona de Tresali', 'Raxao' and 'Regona' trees. On suitable trees selected in Mars or April, trunk section was measured and blossom density index calculated. Treatments were allocated at random. Treatments and replications in each trial are presented in Table 1. An unsprayed control was included in all trials.

Table 1: Cultivars, treatments and replications in each trial. PS: potassic soap; CP: calcium polysulfide; OO: olive oil; B: benzyladenine; NAA: naphthalene-acetic acid; E: ethephon; FIHT: Flower hand-thinning; FrHT: Fruit hand-thinning.

Year of trial	Cultivar	Treatment	N° of replicates
2006-2007	GoldRush	PS + OO (5%), PS + OO (4%), PS (5%), PS (4%), CP (4%), CP (3%), Control	6
	Xuanina	PS + OO (5%), PS (5%), CP (4%), Control	4
2007	Raxao	FIHT, FrHT, PS + OO (4%), PS (4,5%), CP (4%), Control	15
	Regona	FIHT, FrHT, PS + OO (4%), PS (4,5%), CP (4%), Control	15
	Durona de Tresali	PS + OO (4%), B + NAA, B+NAA+E, Control	6
	Raxao	PS + OO (4%), B + NAA, B+NAA+E, Control	6
	Regona	PS + OO (4%), B + NAA, B+NAA+E, Control	6

Depending on cultivar, either potassic soap (alone or with olive oil) or calcium polysulfide at any concentration was applied twice at full bloom (FB) and one week later. Treatments with Benzyladenine + Naphthalene-Acetic Acid (NAA) were applied twice during the early post-bloom period (one and two weeks after FB), and Ethephon three weeks after FB. Hand-thinning of flowers ("extinction" technique) to six inflorescences per cm² of trunk section was done at tigh cluster stage, and hand-thinning of fruits to one fruit per inflorescence was done after petal fall and as early as fruit setting was visible. All trees were sprayed by hand lance to the point of drip and weather.

Main data recorded were fruit load (kg of fruit per cm² of trunk section), fruit weight and vegetative growth (% variation of trunk section measured at 40 cm height). Data were analyzed by General Linear Models, with 'treatment' as fixed variable.

Results

'GoldRush'

In 2006 almost all treatments thinned significantly compared with the control ($F = 2,81$; $p = 0,03$; Fig 1). Although no significant differences were detected in accumulated production ($F = 0,82$; $p = 0,56$), three of them (calcium polysulfide at 3% and potassic soap at 4% with or without olive oil) produced an increment compared to the control. Treatments also had a positive influence on fruit-size and tree growth.

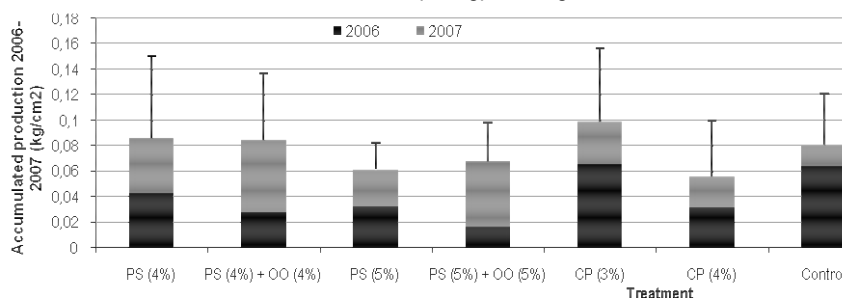


Figure 1: Effect of products and concentrations on the total production of cv. 'GoldRush'. PS: potassic soap; OO: olive oil; CP: calcium polysulfide.

'Xuanina'

Results were similar to those of 'GoldRush': all treatments thinned significantly compared to the control (2006 year; $F = 3,60$, $p = 0,05$; Fig. 2). However, only one of them (calcium polysulfide at 4%) produced a heavier accumulated production than the control, although no significance differences were detected ($F = 1,91$; $p = 0,18$). Significant differences were detected neither at apple size nor tree growth.

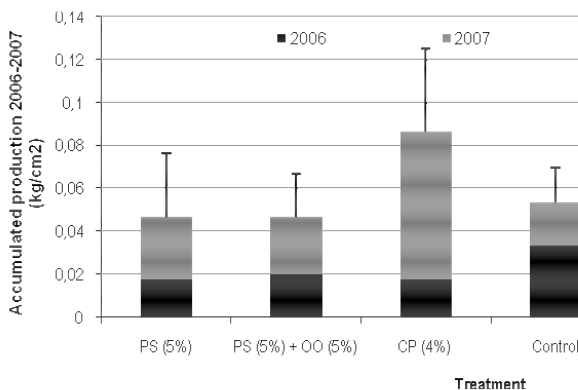


Figure 2: The effect of different products and concentrations on the total production of cv. 'Xuanina'. PS: potassic soap; OO: olive oil; CP: calcium polysulfide.

'Trials initiated at Spring 2007'

In 2007, new trials were initiated to compare Potassic Soap and Calcium Polysulfide effects with hand-thinning and with chemical thinning products (Benzyladenine + Naphthalene-Acetic Acid (NAA) with or without Etephon).

In Fig. 3 the first results of those experiments in some cultivars are presented. The return bloom o these experiments will be controlled in 2008.

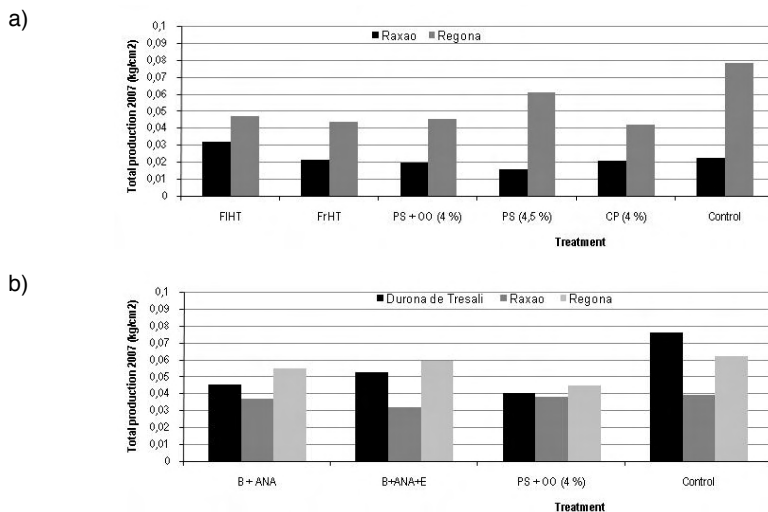


Figure 3: Effect of different thinning techniques on the total production of fruit. PS: potassic soap; CP: calcium polysulfide; OO: olive oil; B: benzyladenine; NAA: naphthalene-acetic acid; E: ethephon; FIHT: Flower hand-thinning; FrHT: Fruit hand-thinning.

Conclusions

- 1 Potassic Soap and Calcium Polysulfide are able to thin cider apple trees, and to increase the production next year, increasing the accumulated production. The effectiveness varies according to the meteorological conditions.
- 2 The first results of the new trials of 2007 show that the effectiveness of PS and CP is similar to those of conventional chemical products.
- 3 In 2008 will be evaluated their ability to increase the return bloom.

Acknowledgements

Alfonso Fernández-Ceballos had a scholarship granted by Caja Rural de Gijón. The experiments were done in the framework of the projects FICYT PC04-56 and INIA RTA-2006-00156-00-00 granted by Asturias and Spain Governments.

References

- Carbó, J., Vilardell, P., Casals, M., Bonany, J. 2002. Trials on Chemical Thinning 2002. Eufirin Working Group on Fruit Chemical Thinning.
- Dennis, F.G.Jr. 2000. The History of Fruit Thinning. *Plant Growth Regulation* 31, 1-16.
- Dennis, F.G.Jr. 2002. Mechanisms of Action of Apple Thinning Chemicals. *Hortscience* 37, 471.
- Kelderer, M., Lardschneider, E., Casera, C., Morten M. 1995. Ertragsregulierung im ökologischen Obstbau: Einsatzzeiner. Kaliseife zu verschiedenen Zeitpunkten. 7. Internationaler Erfahrungsaustausch über Ökologischen Obstbau. *FÖKO*, 163-167.
- Kelderer, M., Lardschneider, E., Casera, C. 2002. *Results of 5 years of thinning trials with lime sulphur in South Tyrol*. 10th International Conference on Cultivation Technique and

Phytopathological Problems in Organic Fruit-Growing and Viticulture. Förderungsgemeinschaft Ökologischer Obstbau e. V. Weinsberg 10, 112-117

- McArtnye, S., Campbell, J., Foote, K. 2000. Thinning Options for Organic Apple Production [on line]. Available at <http://www.fruitgrowers.org.nz/orchardist/articles/2000/10-32.htm> [Feb, 2004].
- Pfeiffer, B., Ruess, F. 2002. Screening of Agents for Thinning Blossoms of Apple Trees. Proc. 10th International Conference on Cultivation Technique and Phytopathological Problems in Organic Fruit Growing and Viticulture. Weinsberg, Germany, 106-111.
- Warlop, F., Libourel, G. 2002. Regulation de la charge du pommier en agriculture biologique: quelques éclaircissements. Le fruit belge 496, 51-54.
- Weibel, Franco P.; Chevillat, Véronique S.; Tschabold, Jean-Luc and Stadler, Walter (2006) Fruit thinning in organic apple growing with optimized timing and combination strategies including (new) natural spray products and mechanical rope-devices . In Boos, Markus, Eds. *ecofruit - 12th International Conference on Cultivation Technique and Phytopathological Problems in Organic Fruit-Growing: Proceedings to the Conference from 31st January to 2nd February 2006 at Weinsberg/Germany*, page pp. 183-197.