Alternative methods of thinning apple

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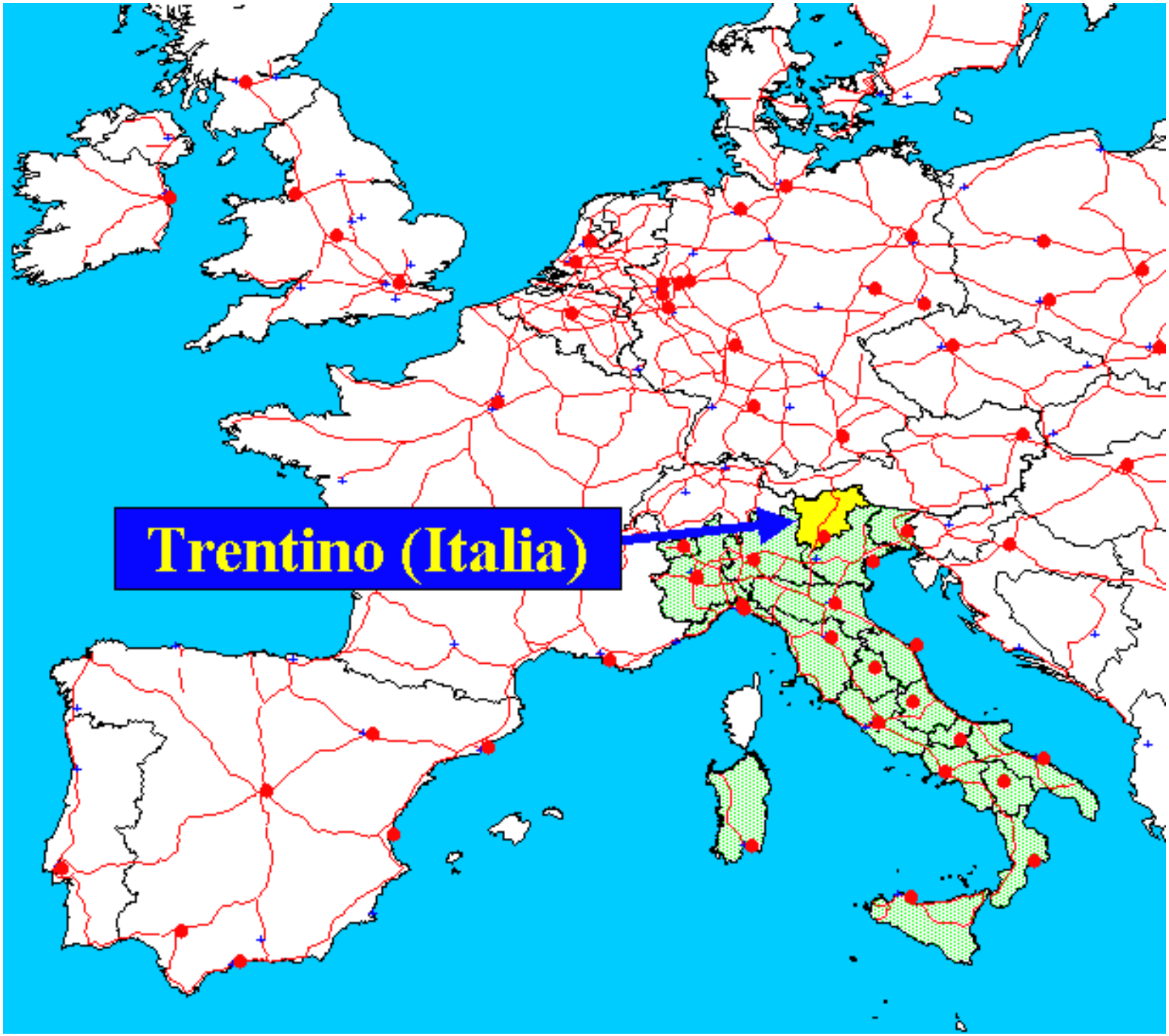

Trentino (Italia)

Apple production by state (F.A.O. - 2010)

Rank	Area	Production (Int $1000)	Flag	Production (MT)	Flag
1	China	14068312	*	33265186	
2	United States of America	1780493	*	4210060	
3	Turkey	1099576	*	2600000	
4	Italy	932512	*	2204970	*
5	Poland	786184	*	1858970	
6	India	751602	*	1777200	
7	France	723703	*	1711230	
8	Iran (Islamic Republic of)	703064	*	1662430	
9	Brazil	540919	*	1279030	
10	Chile	465205	*	1100000	F
11	Argentina	444059	*	1050000	F
12	Russian Federation	416993	*	986000	*
13	Ukraine	361591	*	897000	
14	Germany	353116	*	834960	
15	Japan	337570	*	798200	
16	Democratic People's Republic of Korea	318158	*	752300	F
17	South Africa	306287	*	724232	
18	Uzbekistan	265167	*	712000	*
19	Spain	243598	*	596000	
20	Mexico	247258	*	584655	

* : Unofficial figure

[ ]: Official data

F : FAO estimate

* 70% in Trentino Alto Adige

THE EXPERIMENT FARMS

Adige valley,
210 m a.s.l.

- 12 hectars
- 90 trials

Non valley,
650 m a.s.l.

- 2,5 hectars
- 30 trials

The “standard way” of controlling crop:

Chemical Thinning

Thinners available in Italy

Active Ingr.	Cultivar	Thinning action
NAD (amid of NAA)	Golden - Gala Morgenduft - Granny Smith – Pink Lady	MODERATE
NAA (naphtalen acetic acid)	Golden - Gala - Fuji Pink Lady - Braeburn	MEDIUM - STRONG
Carbaryl *	Golden - Gala - Pink Lady Red Del. - Morgenduft - Fuji Braeburn - Granny Smith	MEDIUM
BA (6-benzyladenine)	Golden - Gala - Fuji Pink Lady - Granny Smith	MODERATE
etephon (CEPA)	Red Delicious - Fuji	FROM WEAK TO VERY STRONG
ATS (ammonium thio-sulphate)	All cultivars	MODERATE-MEDIUM

* withdrawn in 2008

After carbaryl was withdrawn in 2008 thinning strategies have changed:

Since there are no more aggressive thinners for fruitlets (like old **BA +carbaryl**) flower thinning is now crucial

flower thinning

<<<<<<<<<<<<<<

fruitlet thinning

Common thinning strategies for Golden, Gala and Pink Lady

	Timing		Fruitlet diameter	
Efficacy	**F.B***	**B.P.F.****	**9-10 mm**	**12 mm**
weak		NAD 84 ppm		
				BA 100 ppm
		NAD 84 ppm		BA 100 ppm
		NAD 84 ppm	BA 75 ppm	BA 75 ppm
		NAD 84 ppm		BA 100 ppm + NAA 10 ppm
	ATS	NAD 84 ppm		BA 100 ppm +
	ATS	NAD 84 ppm	BA 75 ppm	BA 75 ppm +
	ATS	NAD 84 ppm		BA 100 ppm + NAA 10 ppm
aggressive				

* 2-3 treatments. from Full Bloom

** Beginning Petal Fall

The alternative ways:

1) Mechanical thinning: Darwin

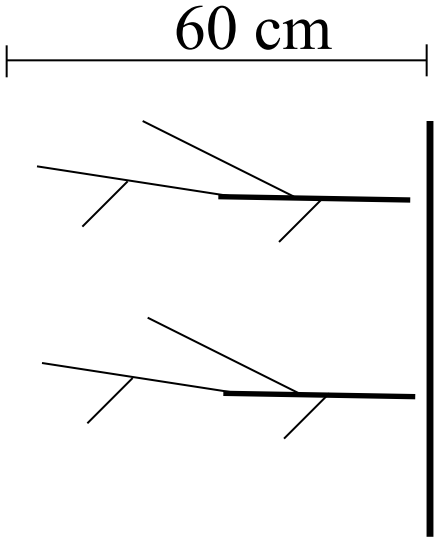
2) Physical control of set: multi-purpose nets

Mechanical thinning

Mechanical thinning efficacy is reated to tree training

Ideal branches for mechanical thinning with Darwin

How to get short branches

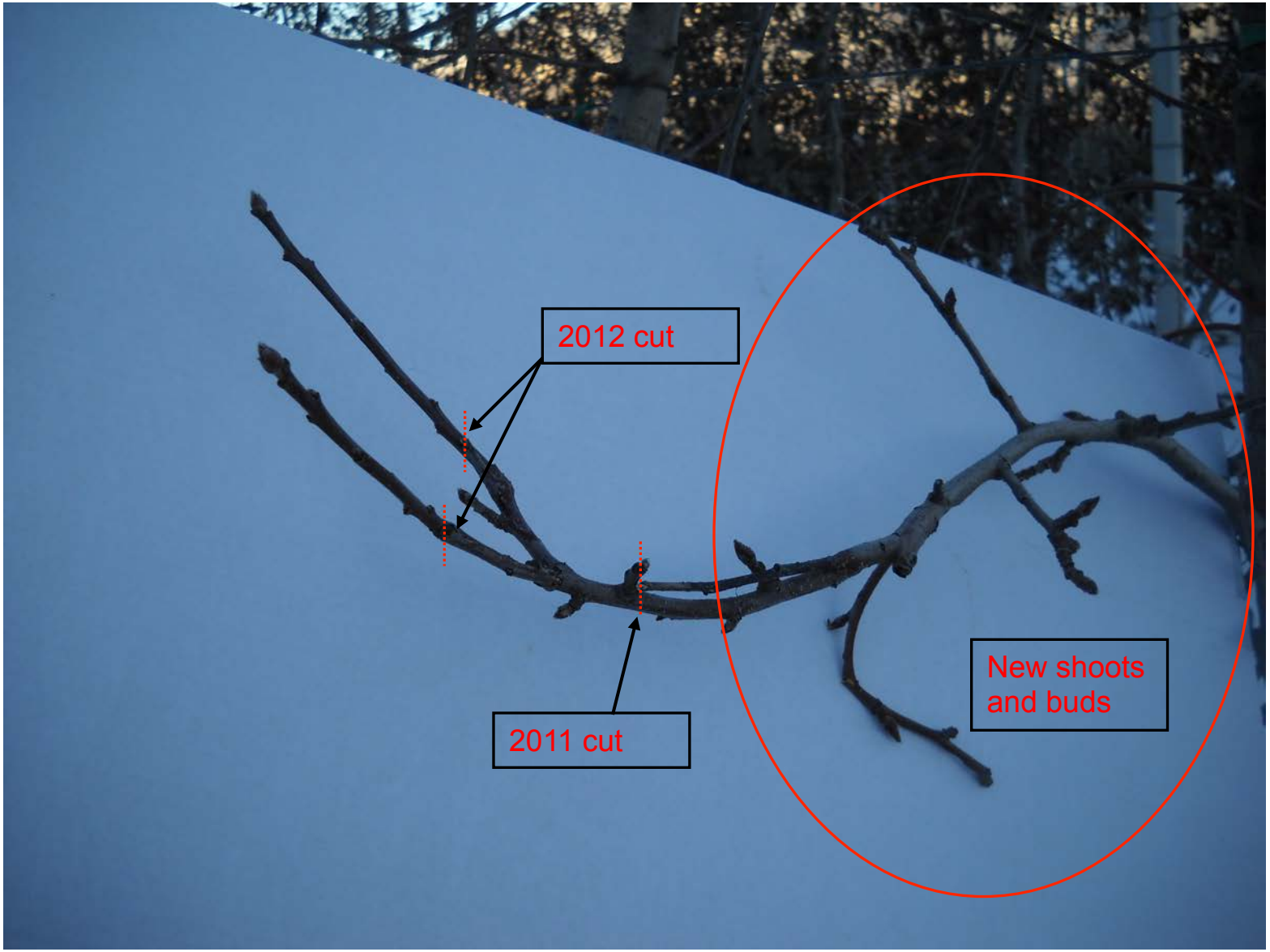


- short hand pruning
- low fertile soils

or/and

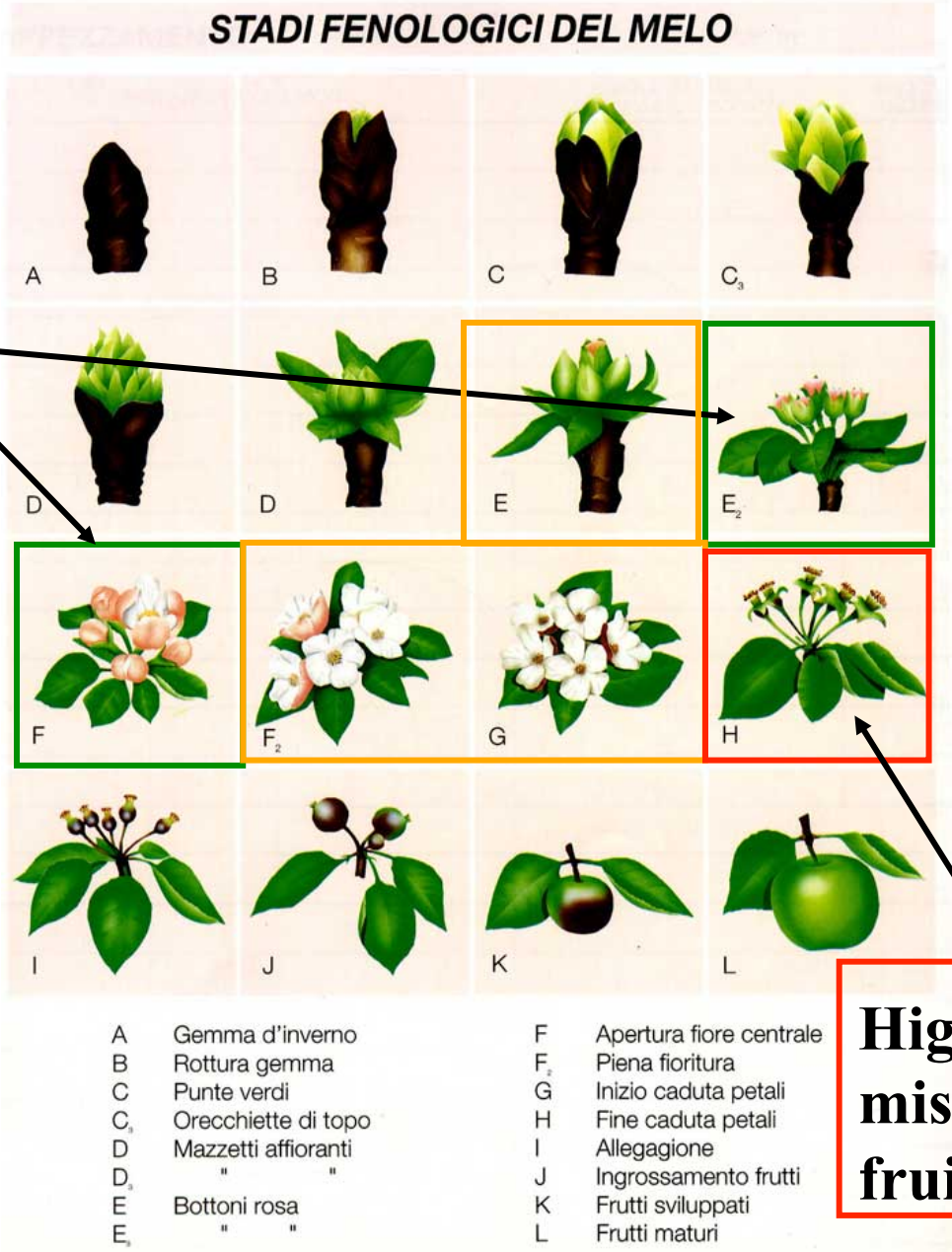
- Bi-Baum trees,
- mechanical pruning

Fruit wall of Golden Bi-Baum: the repeated cuts over the years promote new shoots and buds near the trunk



Best timing for mechanical thinning

Mech. thinning possible



High risk of mis-shaped fruits

Factors affecting the thinning action of chemical/mechanical

Chemical thinning

Meteo conditions before and during treatment (T°, R.H., rain, wind)

How you treat (volume of water)

Intake of the a.i. by the tree (coformulates and adjuvants)

Meteo conditions after the treatment (light, T°)

Interaction of the a.i. with other PGR's and the hormonal state of the tree

THINNING ACTION
noticeable after 15-20 days

Mechanical thinning of flowers

Rotation speed (r.p.m.) & Tractor speed (km/h)

Tree training (width of the tree-row)

MECHANICAL THINNING ACTION
of flowers (80%)
directly perceivable

HORMONAL THINNING ACTION
on fruitlets (20%)
noticeable after 20-30 days

Advantages of mechanical thinnning versus chemical

- ***More consistent*** over the years***;***
- "***Quantitative***": efficacy can be increased by changing rpm;
- ***Visibile:*** most of the effect can be seen, allowing corrections;
- ***Indipendent*** from meteo, cultivar (and species), but also from PGR's availability and from the market;
- ***Cheap, easy and fast*** *to learn;*
- ***Integrated*** if needed with chemicals (BA e NAA);

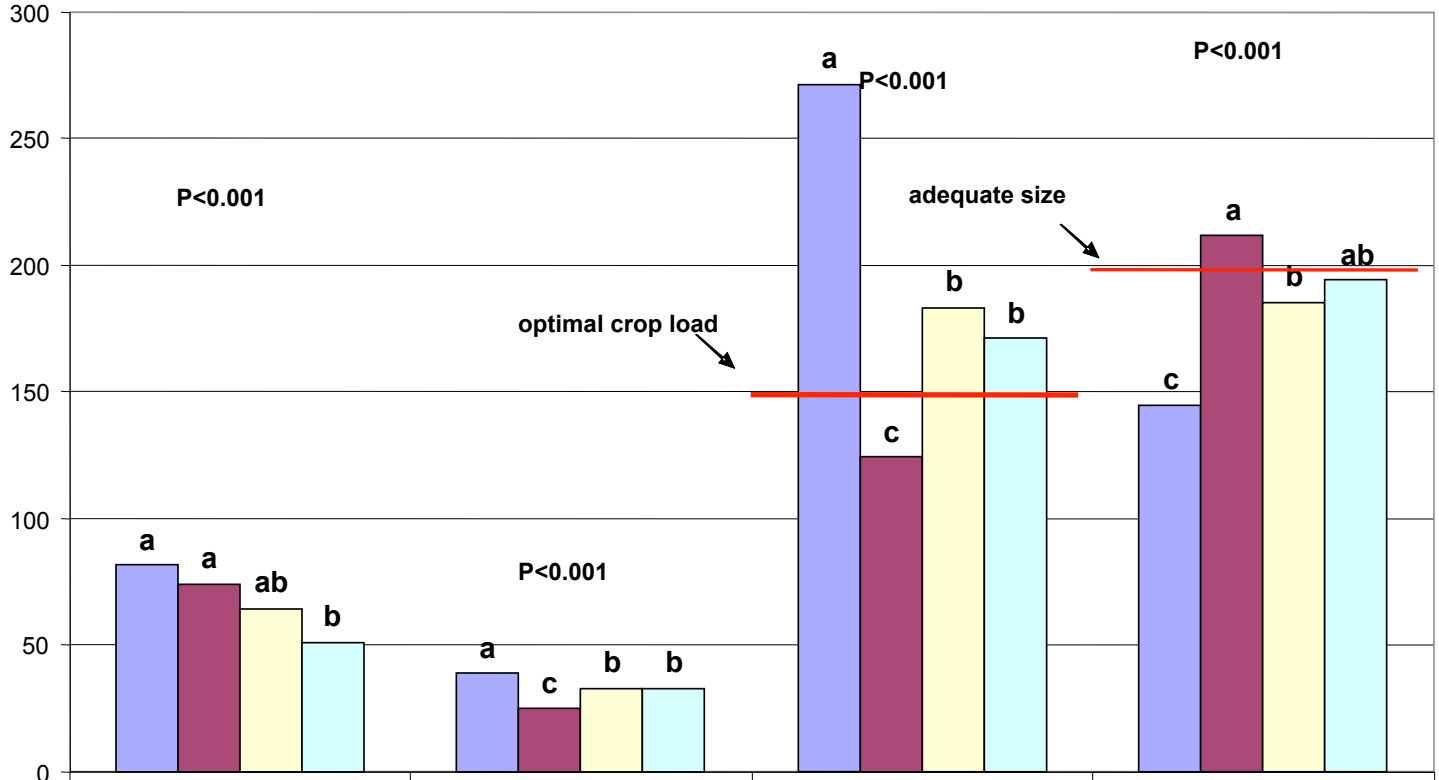
↓

Sustainabile environmentally and economically

A few clusters right after mechanical thinning (6 km/h, 250 rpm)

Removal of about 70% of flowers after intense mechanical thinning on young trees of Golden Delicious (6 km/h, 270 rpm)

Golden Delicious in val d'Adige 2008

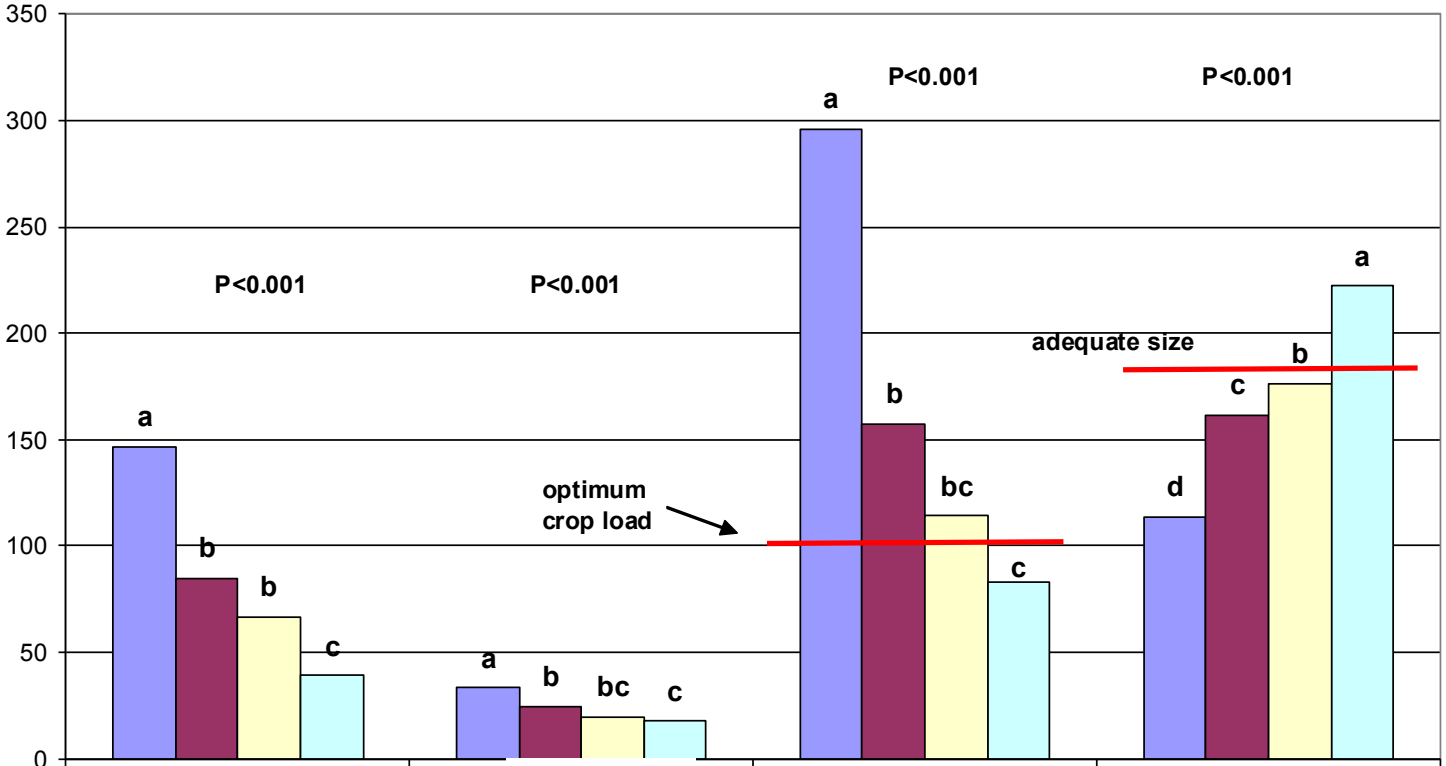


	Fruit set (%)	kg/tree	N. fruits	Fruit weight (g)
UNTREATED	82	39	271	145
NAD-> BA+NAA	74	25	124	212
MECH. TH 260rpm	64	33	183	186
MECH. TH 290rpm	51	33	171	194

Note: Darwin with old set of brush

UNTREATED (Val d'Adige, 2008) MECH. THINN. 290 rpm

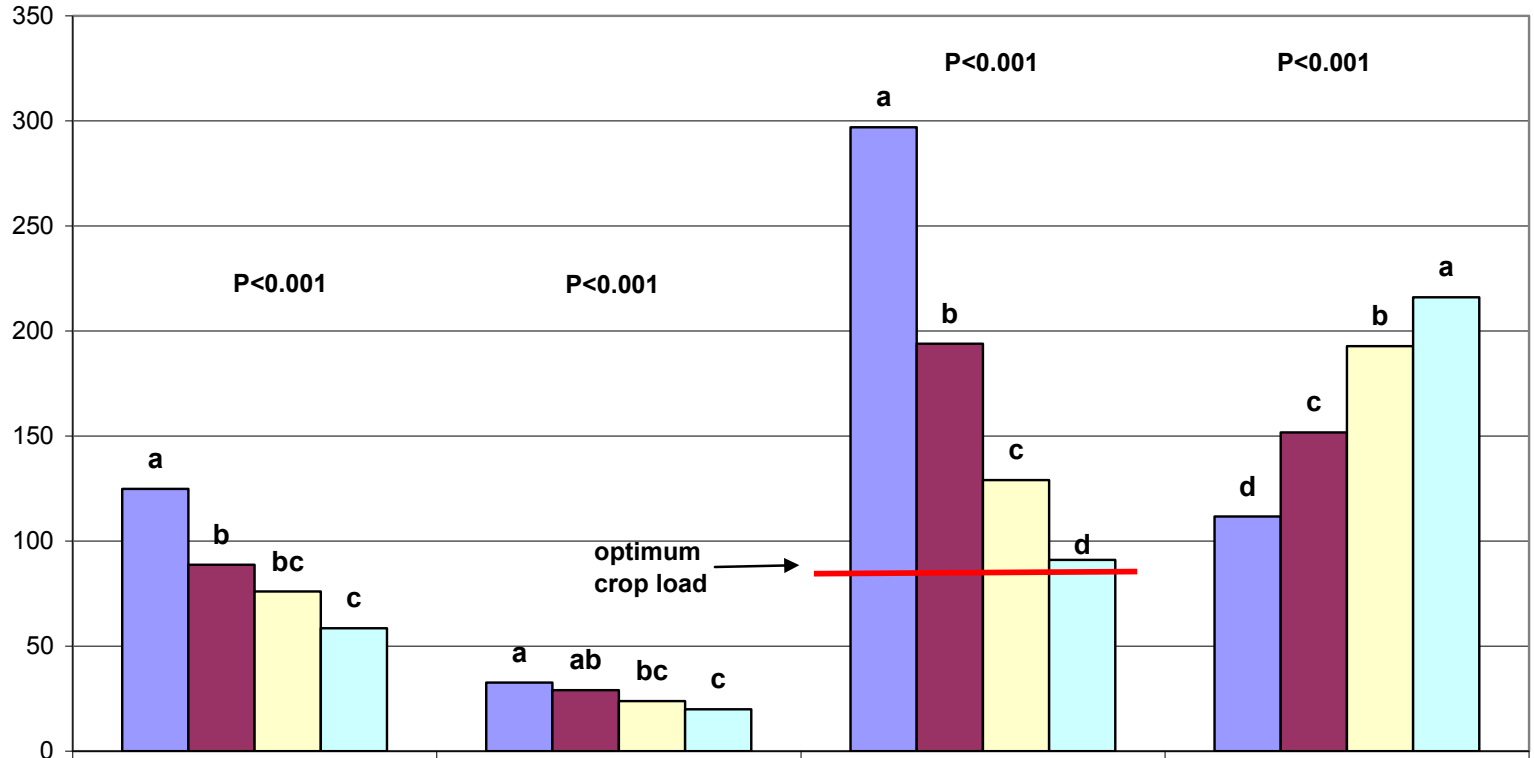
Thinning trial on Gala in the Alpine area (2008)



	fruit set (%)	kg/tree	N. fruits	Fruit weight (g)
UNTREATED	147	33	296	113
NAD-> BA+NAA	85	25	157	162
MECH. THINNING	66	20	114	177
MECH. THINNING -> BA+NAA	39	18	83	222

UNTREATED **val di Non 2008** MECH.THINN. -> NAA+BA

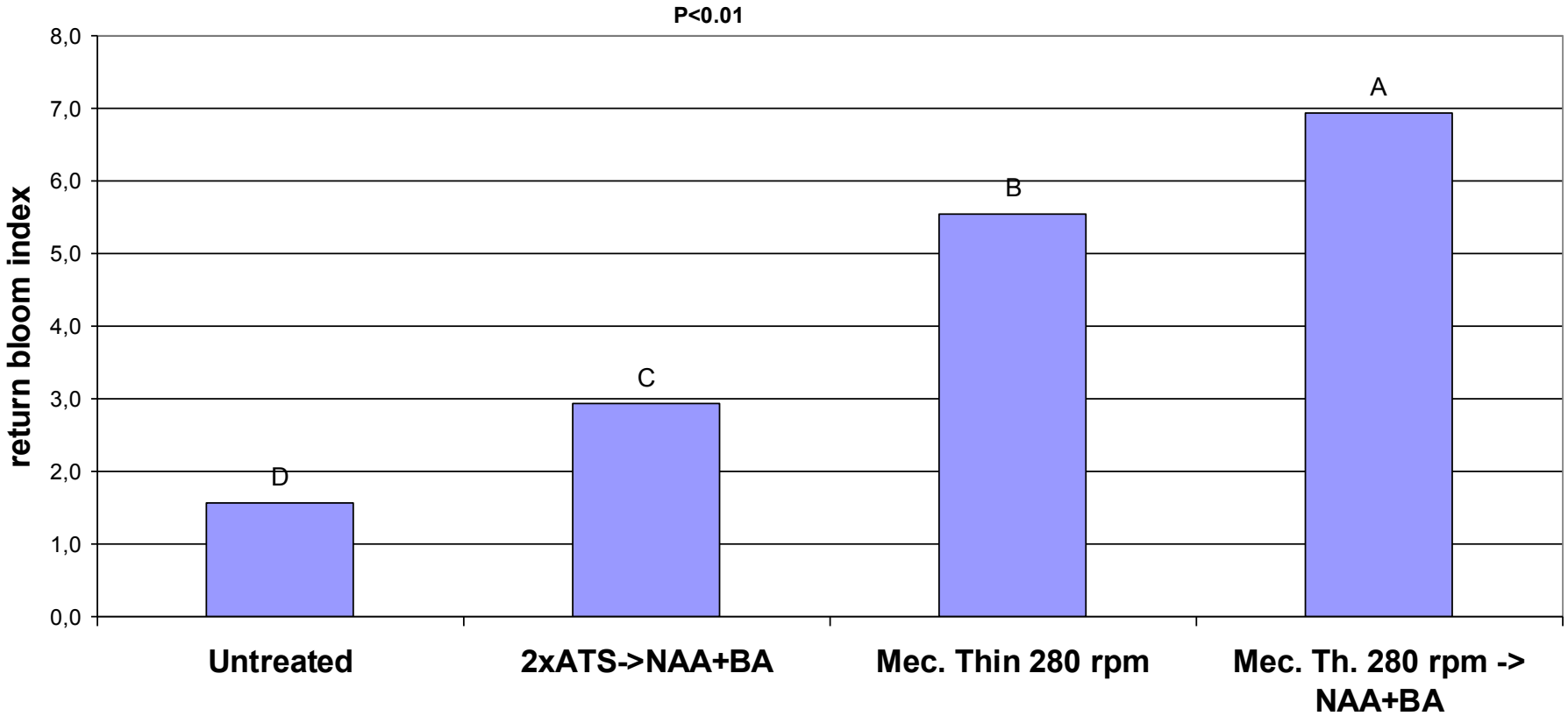
Thinning trial on Fuji in the Alpine area (650 m a.s.l. - 2008)



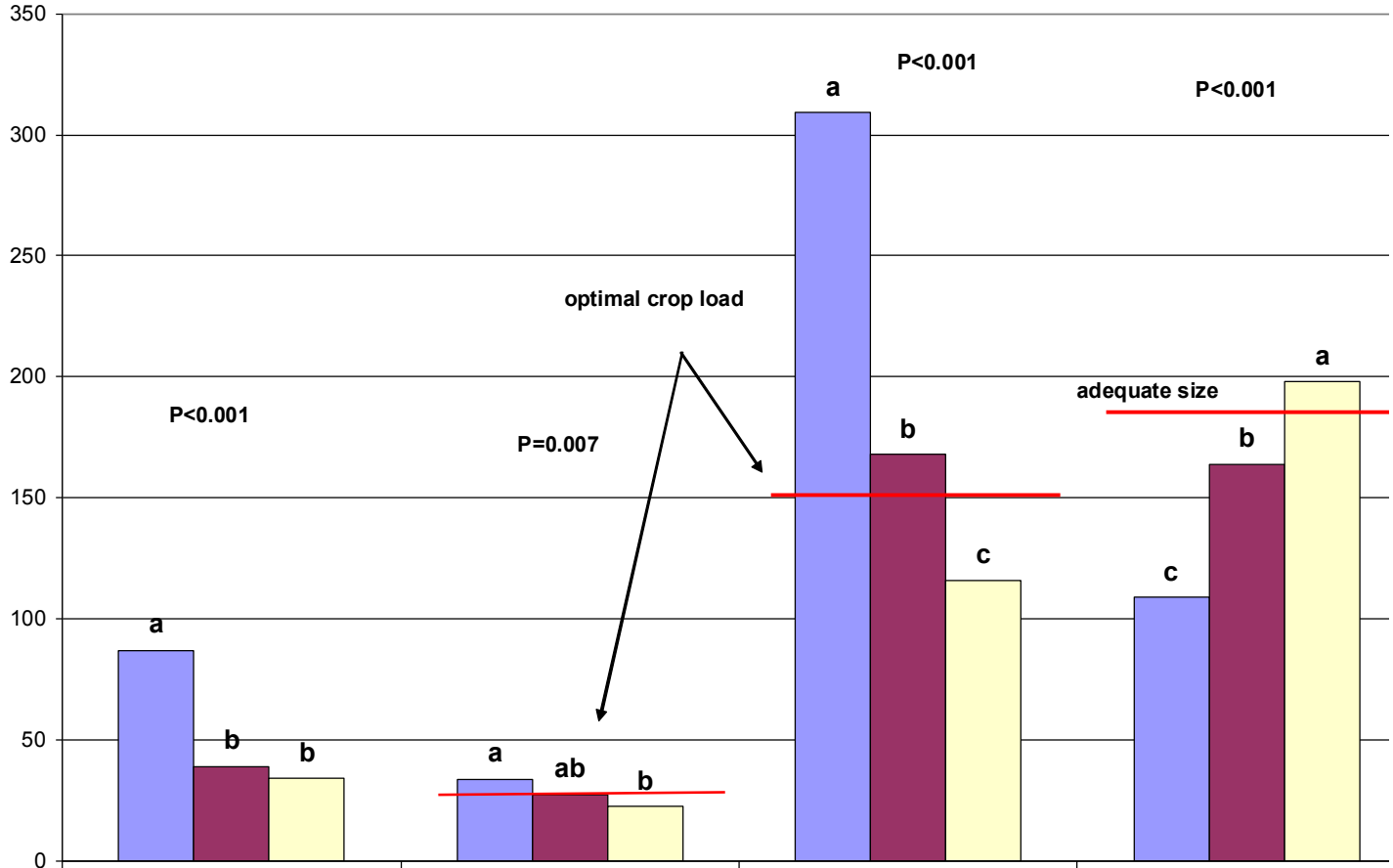
	fruit set (%)	kg/tree	N. fruits/tree	Fruit weight (g)
UNTREATED	125	33	297	112
2xATS -> BA+NAA	89	29	194	152
MECH. THIN. 280 rpm	76	24	129	193
MECH. THIN. -> BA+NAA	59	20	91	216

Return bloom of Fuji
Val di Non, Spring 2009

return bloom index:
1=no flower clusters;
9=only flower clusters on >2 year old wood



Thinning trial on Gala in Adige valley (2009)



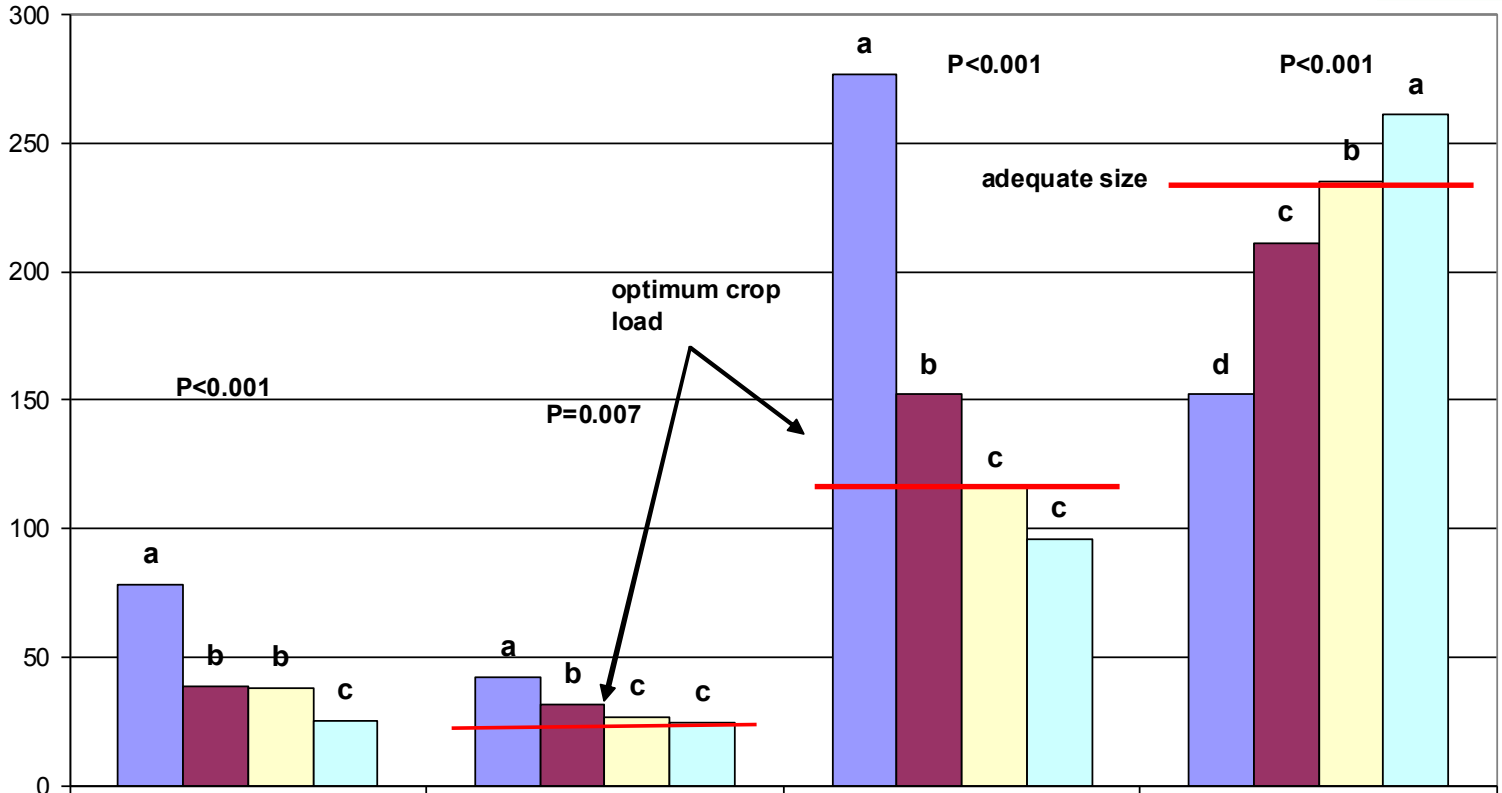
	fruit set (%)	kg/tree	N. fruits	Fruit weight (g)
UNTREATED	87	34	309	109
MEC. TH.. 220rpm, 6 km/h	39	27	168	164
MEC. TH. 220rpm -> NAA+BA	34	22	116	198

Gala trained bi-axes 2009 improve Darwin performance (V. Adige)

UNTREATED

MECH. THINN. 220 rpm

Thinning trial on Fuji Bi-Baum (2009)



	fruit set (%)	kg/tree	N. fruits	Fruit weight (g)
UNTREATED	78	42	277	152
MEC. TH. 230rpm, 6km/h	39	32	152	211
MEC. TH. 230rpm -> BA	38	27	116	235
MEC. TH. 230rpm -> NAA+BA	25	25	96	261

Damage caused by mechanical thinning on apples

light misshape (1%)

strong misshape (<1%)

IASMA trials 2009: efficacy of mechanical/integrated thinning*

Cv / Location	Targeted thinning efficacy	Thinning efficacy mechanic	Thinning efficacy mech.+ chem.	increase in fruit size mechanic	increase in fruit size mech. + chem.
Fuji / v. Adige	57	45	58	39	55
Golden / v. Adige	44	55	73	36	52
Gala / v. Adige	51	46	62	50	82
Red / v. Adige	34	34	45	34	47
Pink Lady / v. Adige	48	37	62	14	38
Braeburn / v. Adige	31	26	---	14	---
Fuji / v. Non	53	61	71	89	124
Golden / v. Non	64	52	65	63	105
Average	**48**	**45**	**62**	**42**	**72**

optimal thinning
sligtht overthinning
overthinning

***Efficacy and increase in weight are both related to UTC as %**

Note: Darwin with old set of brush

Trials with mechanical + chemical thinning 2010-2011 of lasma

Trials 2010

Cv / Location	Targeted thinning efficacy	Thinning efficacy mechanic	Thinning efficacy mech.+ BA	Increase in fruit size mechanic	Increase in fruit size mech. + BA
Fuji / v. Adige	56	22	52	18	66
Golden / v. Adige	51	27	49	26	58
Gala / v. Adige	54	44	53	34	39
Red / v. Adige	46	30	29	6	28
Pink Lady / v. Adige	49	42	43	21	31
Modì	48	67	70	49	55
Fuji / v. Non	57	31	38	34	32
Golden / v. Non	47	39	36	33	30
Average	**51**	**38**	**46**	**28**	**42**

Trials 2011

Cv / Location	Targeted thinning efficacy	Thinning efficacy mechanic	Thinning efficacy mech.+ BA	Increase in fruit size mechanic	Increase in fruit size mech. + BA
Fuji / v. Adige	59	21	31	18	28
Golden / v. Adige	40	28	34	19	27
Gala / v. Adige	52	15	29	9	24
Red / v. Adige	37	26	23	18	18
Fuji / v. Non	66	48	53	59	64
Golden / v. Non	53	21	48	32	73
Average	**51**	**27**	**36**	**26**	**39**

Legenda:

Light thinning
Optimal thinnig
Overthinning

Note: Darwin with new set of brush

The drawbacks of mechanical thinning

- Risk of late frost (with aggressive rpm)

- Need for slender trees and suitable branches

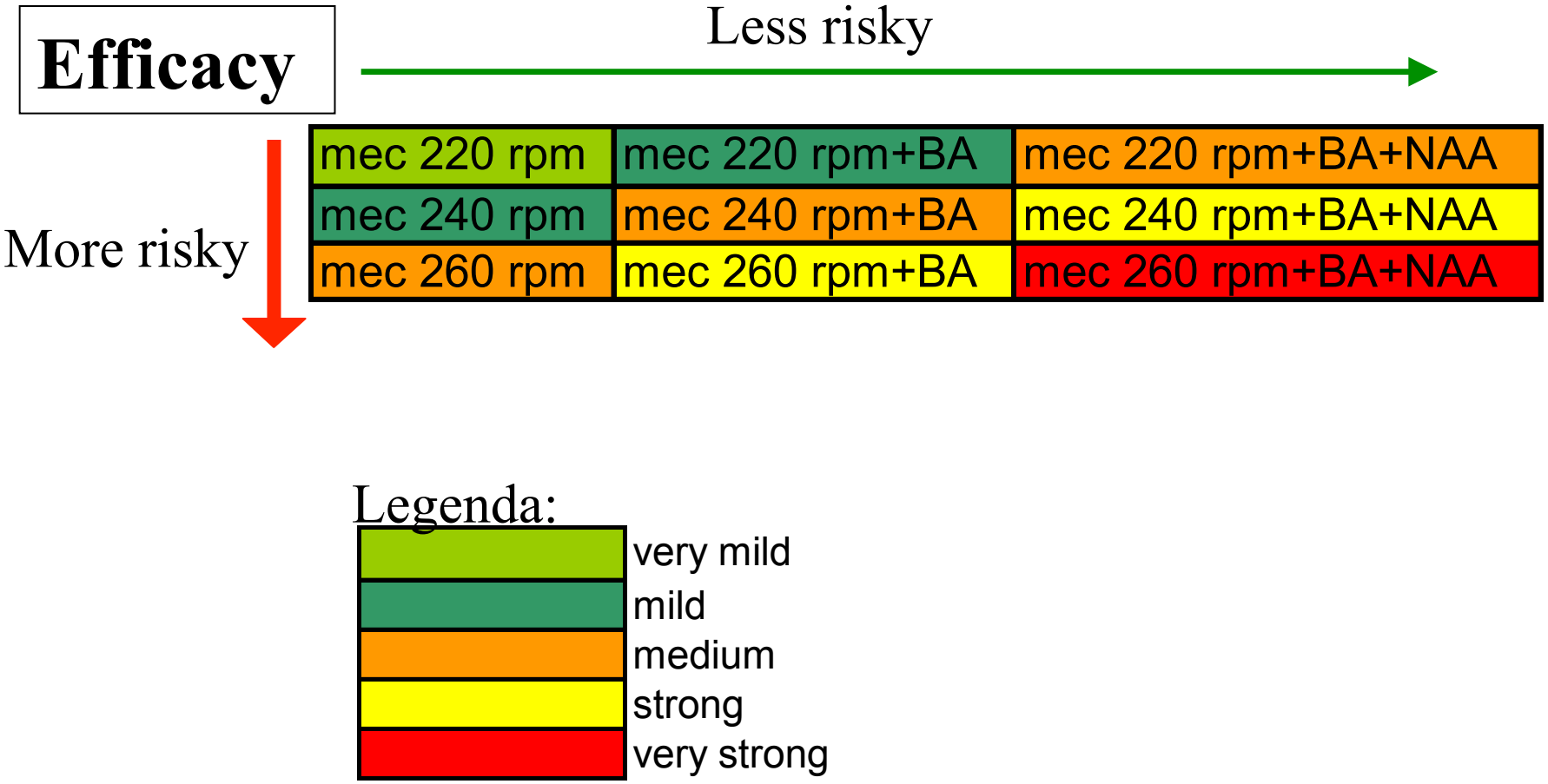
- Not selective in terms of king flower

- Some damage on spur leaves

- Despite the early timing (bloom) and 15 years of observation without a single case in Europe, some concern remains of fire blight transmission in infected areas

- Psycological barrier for many growers/technicians

Integrated thinning: combining mechanical thinning with chemicals results in variable degrees of efficacy (tractor speed of 6-8 km/h)



Suitability of the main apple cultivars to mechanical thinning

Cultivar	Suitability	Why?
Red Delicious	very high	lack of chem. thinners; right tree shape
Fuji	very high	sets heavily; biannual; lack of thinners; pigmys with NAA; elastic branches
Gala	high	sets heavily; lack of thinners; pigmys with NAA; care for the fragile branches!
Golden	high	particularly in hilly sites where it sets heavily
Braeburn	not much	mechanical thinn. is less effective than chemical thinning
Pink Lady	not much	little need for thinning; not alternating; good response to chem. thinn.
Granny Smith	unsuitable	little need for thinning;
Morgenduft	unsuitable	little need for thinning; unsuitable shape

Presence of Darwin machines in Italy (2012)

Region	n. Darwin
Alto Adige	14
Trentino	13
Piemonte	6
Emilia-Romagna	11
Friuli	4
Val d'Aosta	1
Veneto	1
Toscana	2
Tot.	**53**

Thinning by multi-purpose nets

The “Alt'carpo” was an idea of **Guilhem Sévérac** to fight codling moth (France, 2005) that was validated in several countries

Recommander le site | Plan du site | Flux RSS/Ator

Alt' Carpo

Alt' Carpo

Alt' Carpo, une alternative qui dit «halte» au Carpo

- Accueil
- Alt'Carpo une technique Bio
- Elaboration du concept Alt'Carpo
- Experimentations
- Resultats en verger
- Effets secondaires
- Alt'Abeille technique d'eclaircissage alternative
- Préconisations
- Alt'Carpo Mono-Rang Matériel et Cout
- Alt'Carpo Mono-Parcelle Matériel et Cout
- Autres Especes
- Alt'Carpo s'exporte...
- Communications - Publications
- Phototheque
- Contacts
- Actualités

Alt' Carpo

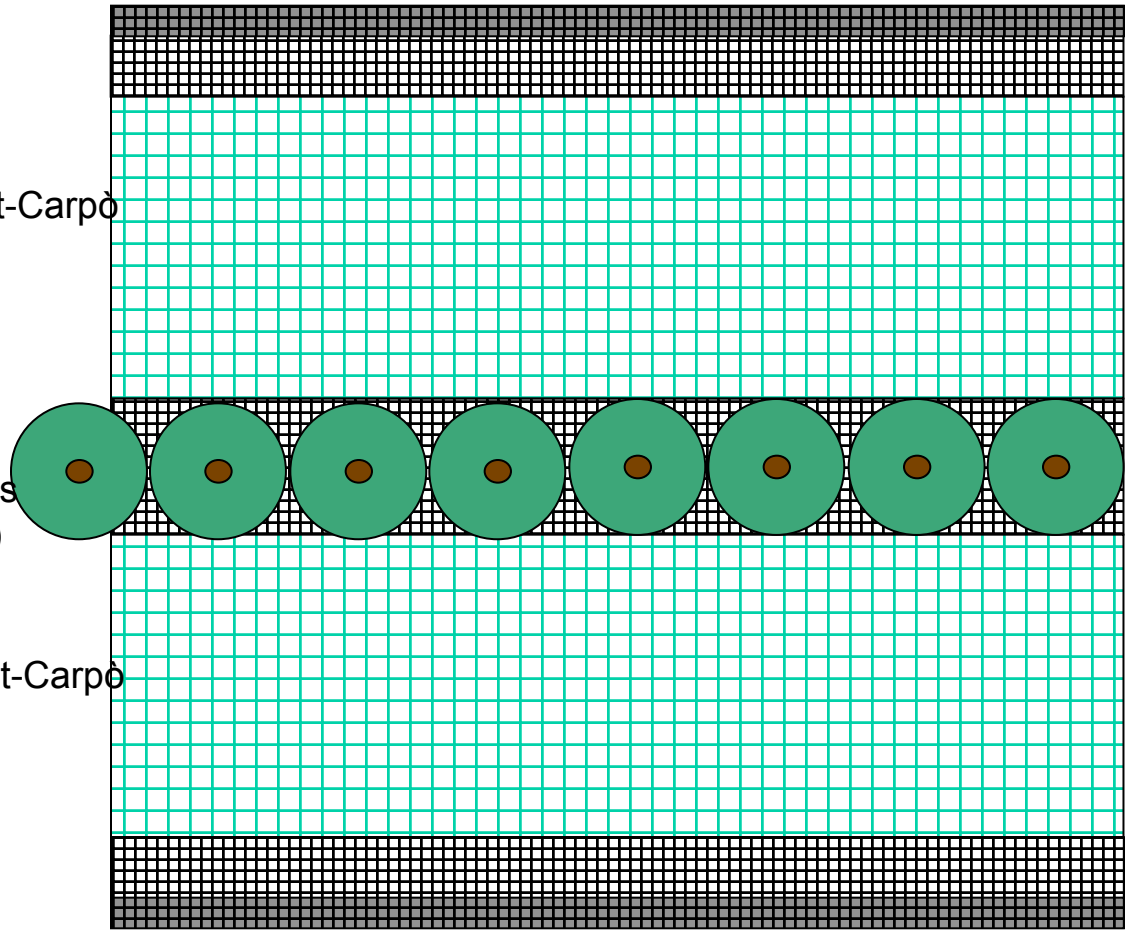



Alt'Carpo, *une alternative qui dit « halte» au Carpo*

Elaboré en 2005, par Guilhem Sévérac (Chambre d'Agriculture de Vaucluse) puis validé expérimentalement en 2006, en collaboration avec Lionel Romet (Groupe de Recherche en Agriculture Biologique) le concept Alt'Carpo se développe en vergers depuis 2007. Alt'Carpo est la dénomination commune que nous avons donnée à cette technique de protection, le *Alt'* faisant référence à la fois au coté Alternatif et à celui de barrière (Halte). Cette méthode de protection alternative est basée sur l'utilisation de filets pour établir une barrière physique autour des arbres. La technique peut se décliner en deux configurations : Alt'Carpo mono-rang ou Alt'Carpo mono-parcelle.

Evolution of the Alt Carpò net for agronomic purposes

1. cimosa
2. black 2x2mm mesh anti-weed
3. white 4x3mm mesh standard alt-Carpò
4. black 2x2mm mesh (high durability, resistant to succers, less sunburn, low visibility from above)
3. white 4x3mm standard mesh alt-Carpò
2. black 2x2mm mesh anti-weed
1. cimosa



Organic farm that makes use of the multi-purpose Alt Carpò nets

Organic farm that makes use of the multi-purpose nets:

Net closed at start bloom

Net closed 5 days after start bloom

Trial on Fuji 2012

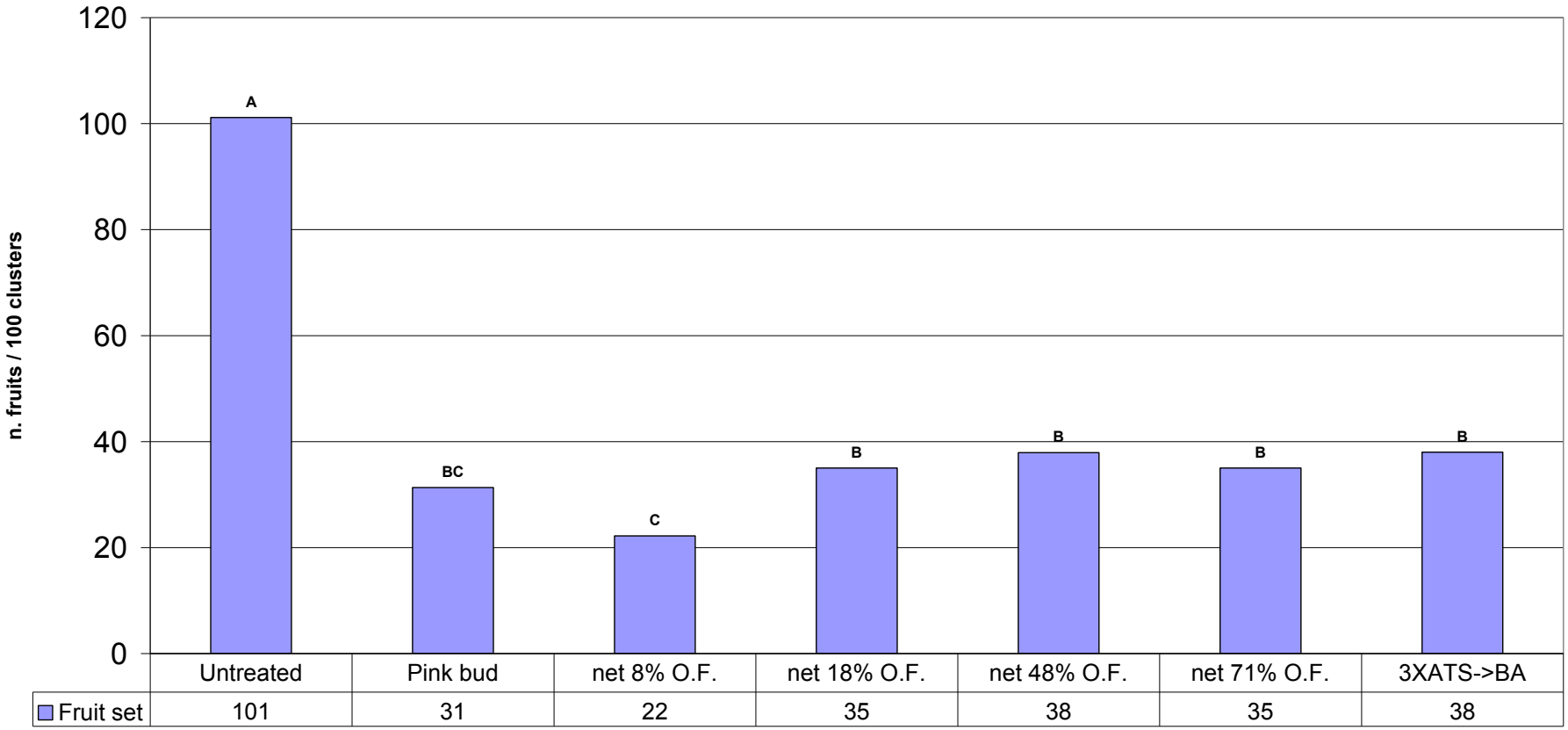
- Untreated
- Under the net from pink bud (28/3)
- Under the net from **8**% O.F. (31/3)
- Under the net from **18**% O.F. (2/4)
- Under the net from **48**% O.F. (5/4)
- Under the net from **71**% O.F. (10/4)

Net closure at **pink bud** stage on Fuji (28/3/2012)

Net closure at **18%** open flowers on Fuji (2/4/2012)

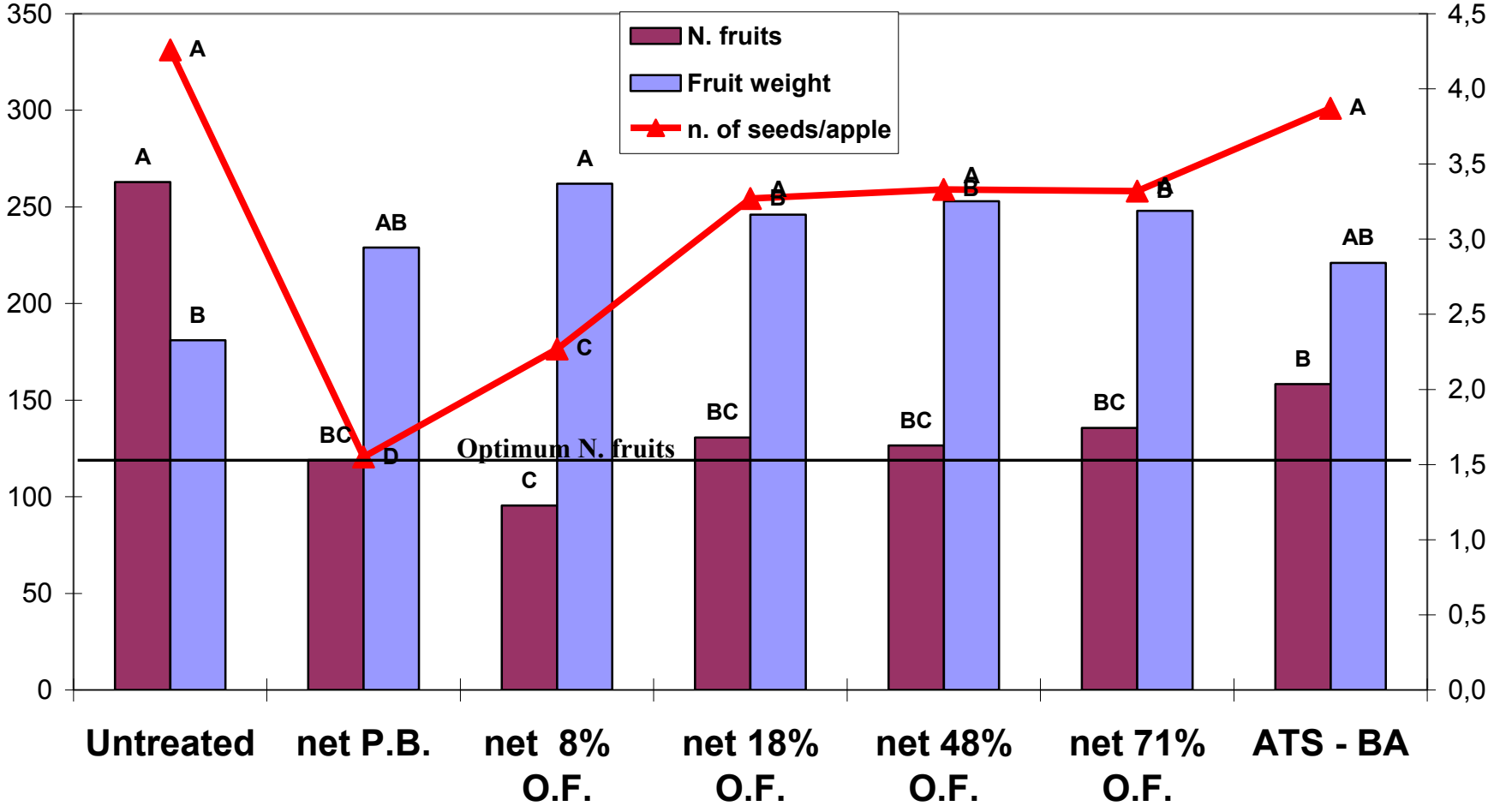
Net closure at **71%** open flowers on Fuji (10/4/2012)

Fruit set of Fuji thinned by means of nets or chemicals



	Untreated	Pink bud	net 8% O.F.	net 18% O.F.	net 48% O.F.	net 71% O.F.	3XATS->BA
Fruit set	101	31	22	35	38	35	38

Fruit production of Fuji thinned by M.P. nets (2012)



Growth control of vigorous Fuji via multi-purpose nets (closure at 2/4/12)

Fuji (27/9/12)

Net at 18% O.F.

Untreated

Net at 18% O.F.

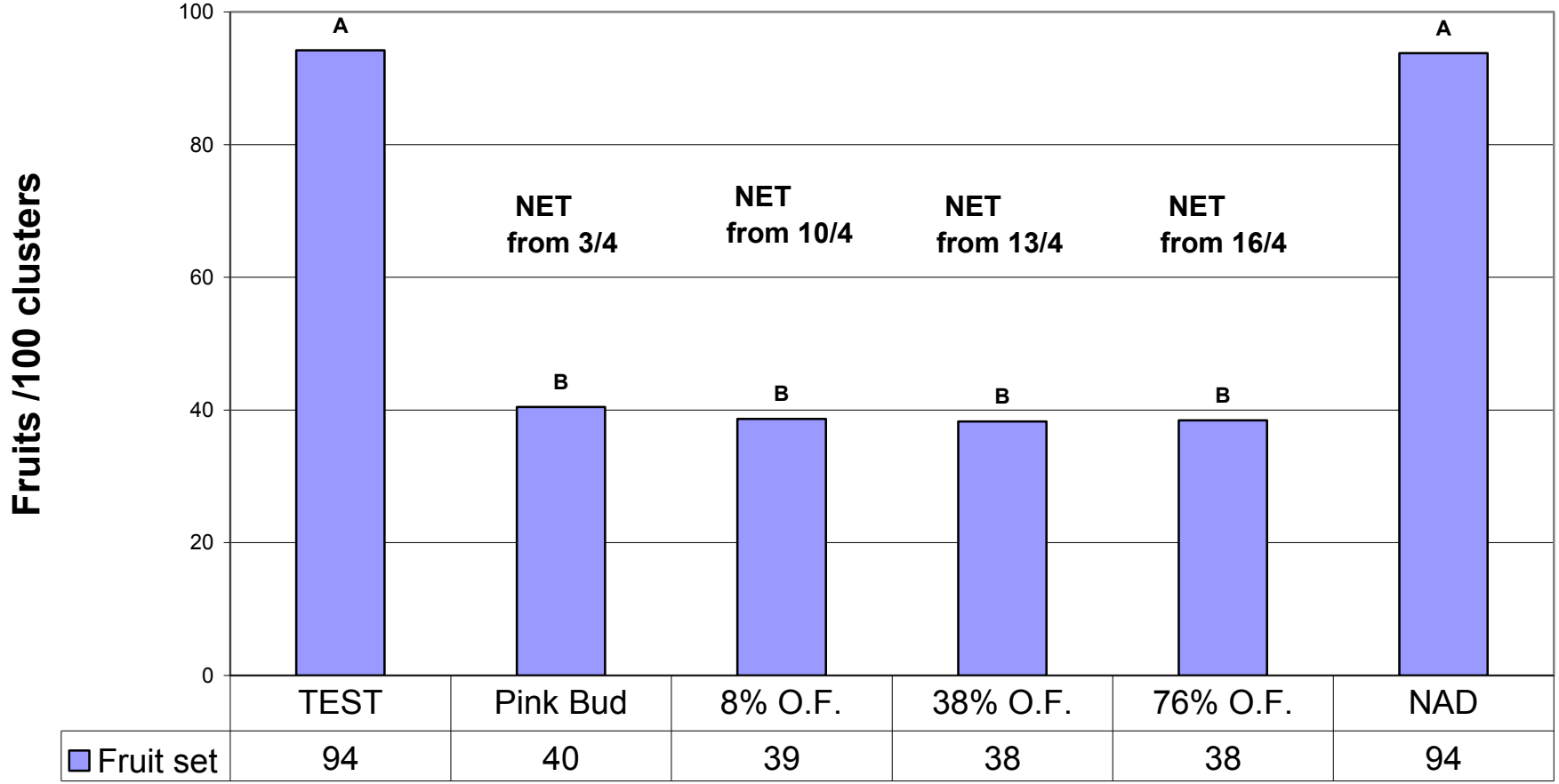
Fuji (27/9/12)

Untreated

Trial on Golden 2012

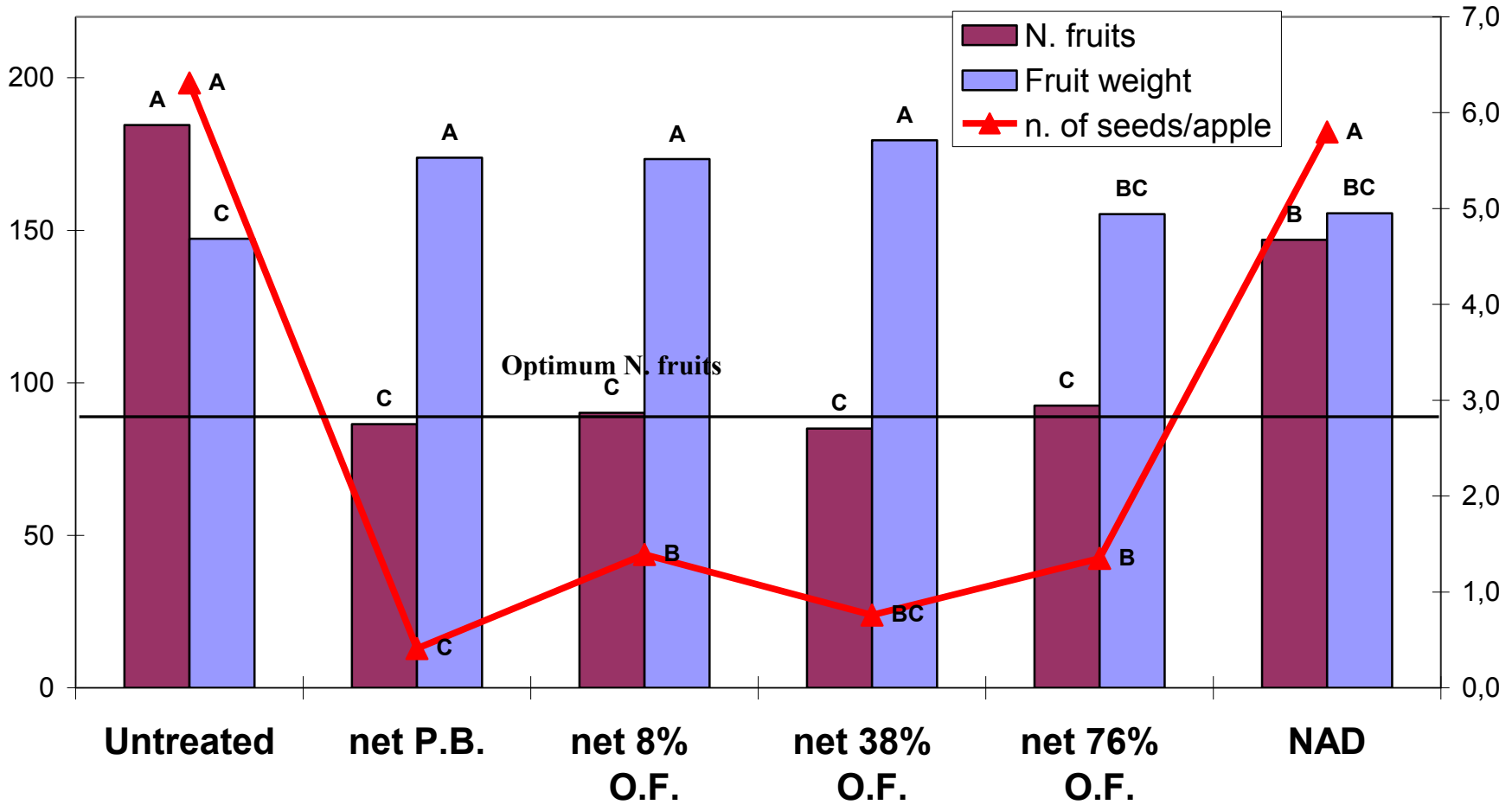
- Untreated
- Under the net from **pink bud**
- Under the net from **8**% O.F.
- Under the net from **38**% O.F.
- Under the net from **76**% O.F.
- Chemical thinning with NAD

Fruit set of Golden Delicious, 2012

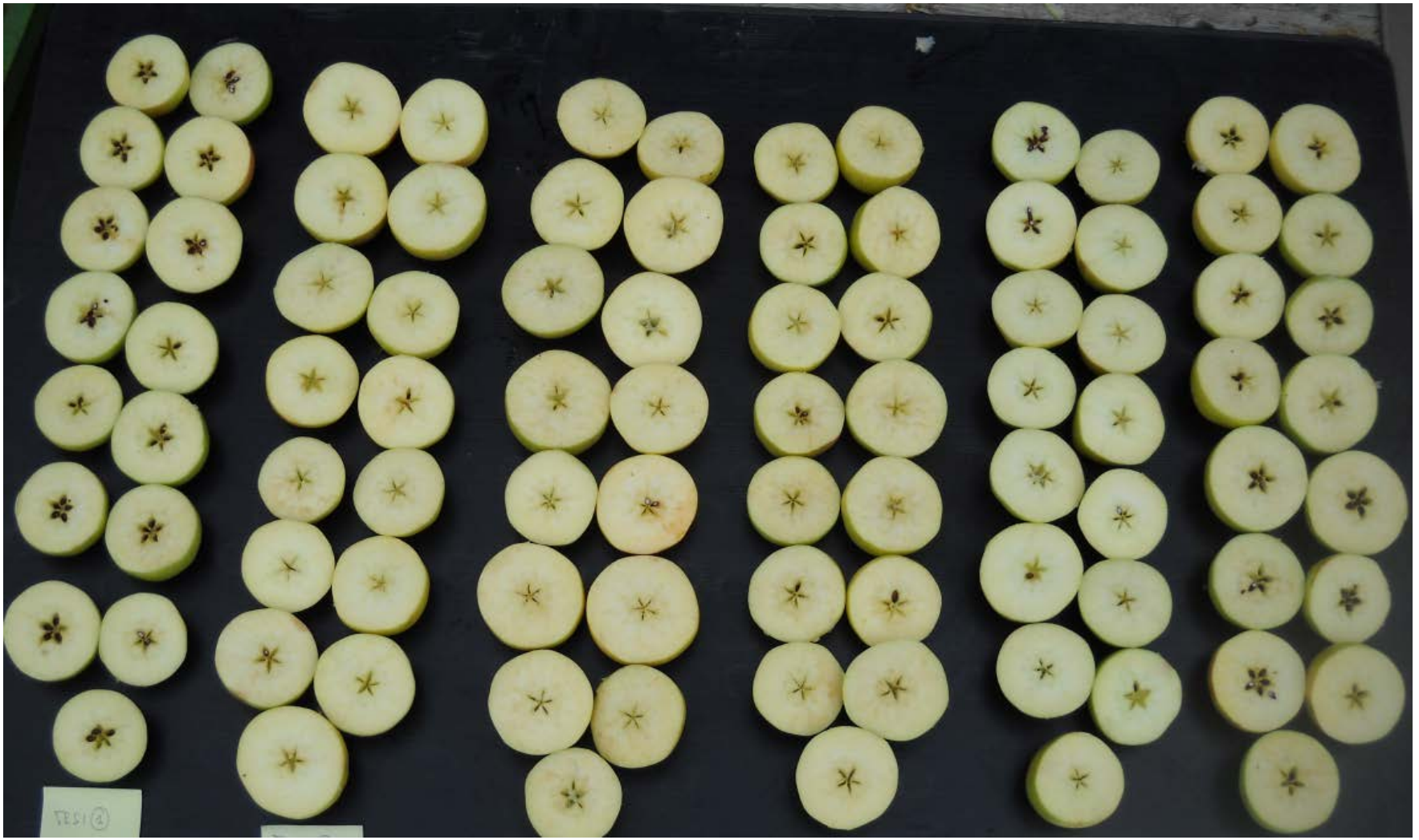


	TEST	Pink Bud	8% O.F.	38% O.F.	76% O.F.	NAD
Fruit set	94	40	39	38	38	94

Fruit production of Golden thinned by M.P. nets



Presence of seeds in Golden apples with and without nets



TEST P.B. 8% O.F. 38% O.F. 76% O.F. NAD

Dwarfing effect of the MP net on Golden Bi-Baum

Without net

Under the net for 2 years


With the net
Without net

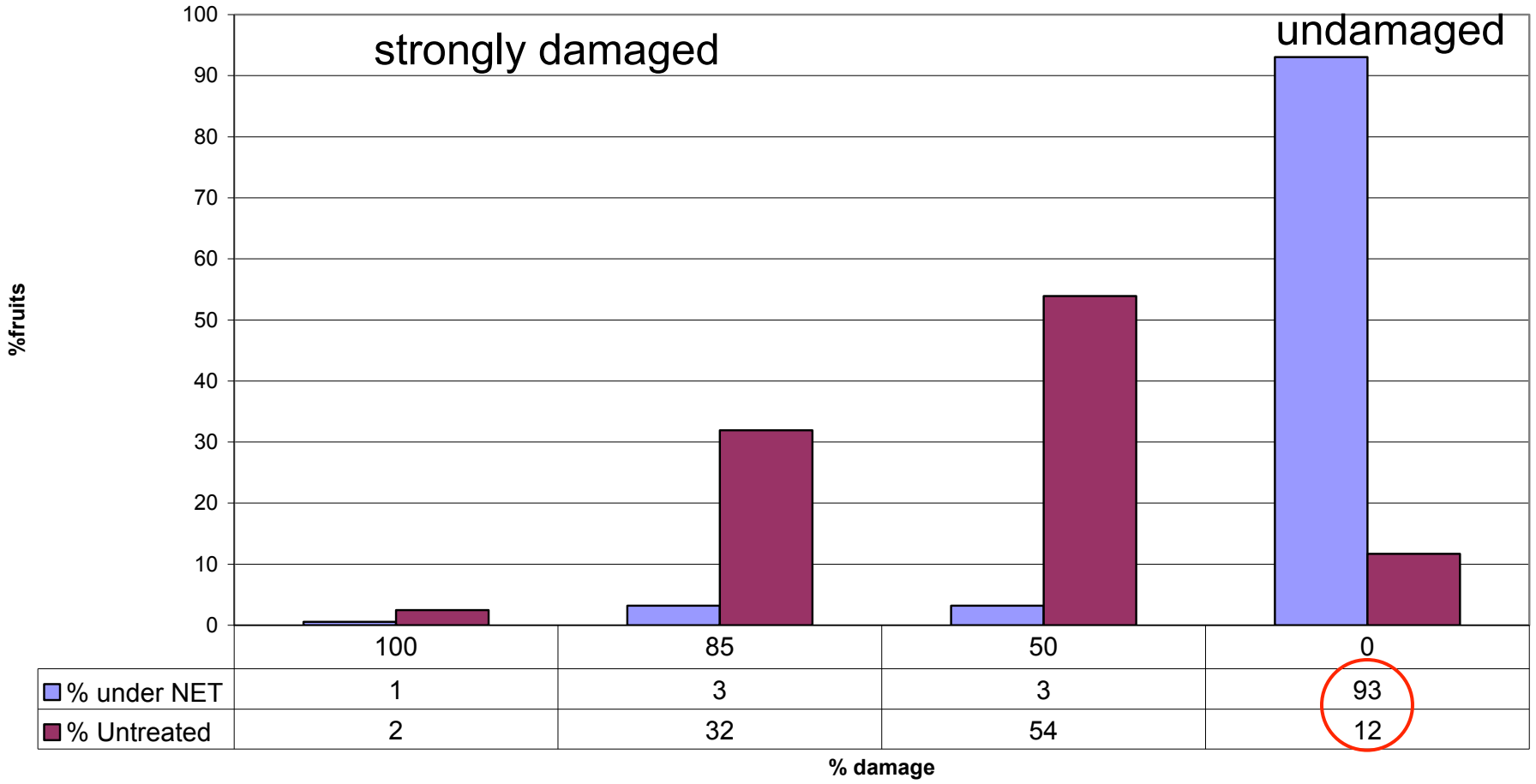
Thinning trial in 2011 on Golden Delicious

Treatment	N. fruits / tree	Fruit weight (g)	N. seeds / fruit	Return bloom index
Net 40% O.F	79 b	172 a	2,5 b	8,2 a
Net 60% O.F	73 b	175 a	2,3 b	8,6 a
Net 100% O.F	95 a	144 b	5,8 a	3,8 b

1= lack of flower buds

9= only flower buds

Damage at harvest under the multi-purpose net after a severe hailstorm on a 3 year-old Golden Bi-Baum (2011)



	100	85	50	0
% under NET	1	3	3	93
% Untreated	2	32	54	12

% damage

Development 2013:

early pollination by wild bees

+

use of nets

Thank you for your attention!