How research can improve sustainability of plant protection in apple production:

overview of past, present and future.

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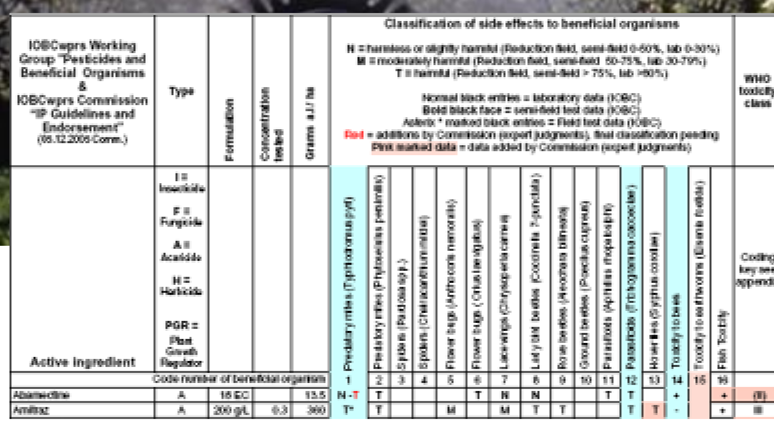
IOBC-WPRS WG Integrated Protection of Fruit Crops

IOBC

www.iobc-wprs.org

Grower: secondary pest control



IOBCwprs Working Group "Pesticides and Beneficial Organisms & IOBCwprs Commission "IP Guidelines and Endorsement" (05.12.2006-Comm.)

Classification of side effects to beneficial organisms

N = harmless or slightly harmful (Reduction field, semi-field 0-50%, lab 0-30%)
M = moderately harmful (Reduction field, semi-field 50-75%, lab 30-79%)
T = harmful (Reduction field, semi-field > 75%, lab >80%)

Normal black entries = laboratory data (IOBC)
Bold black face = semi-field test data (IOBC)
Asterix * marked black entries = Field test data (IOBC)
Red = additions by Commission (expert judgments), final classification pending
Pink marked data = data added by Commission (expert judgments)

Active ingredient	Type (I = Insecticide, F = Fungicide, A = Acaricide, H = Herbicide, PGR = Plant Growth Regulator)	Formulation	Concentration tested	Grams a.i./ ha	Predatory mites (Typhlodromus pyri)	Predatory mites (Phytoseiulus persimilis)	Spiders (Pardosa spp.)	Spiders (Chiracanthium mildei)	Flower bugs (Anthocoris nemoralis)	Flower bugs (Orius laevigatus)	Lacewings (Chrysoperla carnea)	Ladybird beetles (Coccinella 7-punctata)	Rove beetles (Aleochara bilineata)	Ground beetles (Poecilus cupreus)	Parasitoids (Aphidius rhopalosiphi)	Parasitoids (Trichogramma cacoeciae)	Hoverflies (Syrphus corollae)	Toxicity to bees	Toxicity to earthworms (Eisenia foetida)	Fish Toxicity	WHO toxicity class (Coding key see appendix)
Code number of beneficial organism					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
Abamectine	A	18 EC		13.5	N - T	T				T	N	N			T	T		+		+	(II)
Amitraz	A	200 g/L	0.3	360	T*	T			M		M	T	T			T	T	-		+	III

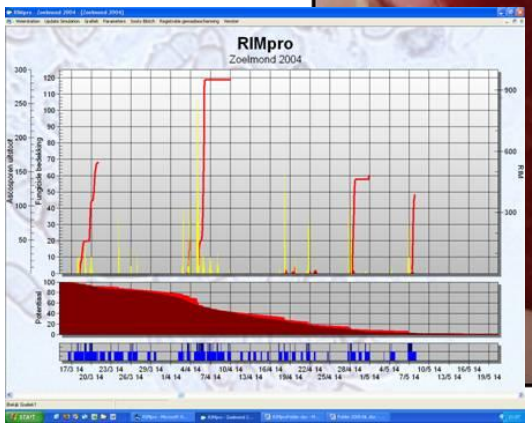
Consumer: pesticide residues issue

Pheromone Mating Disruption

Insect virus

Fungi

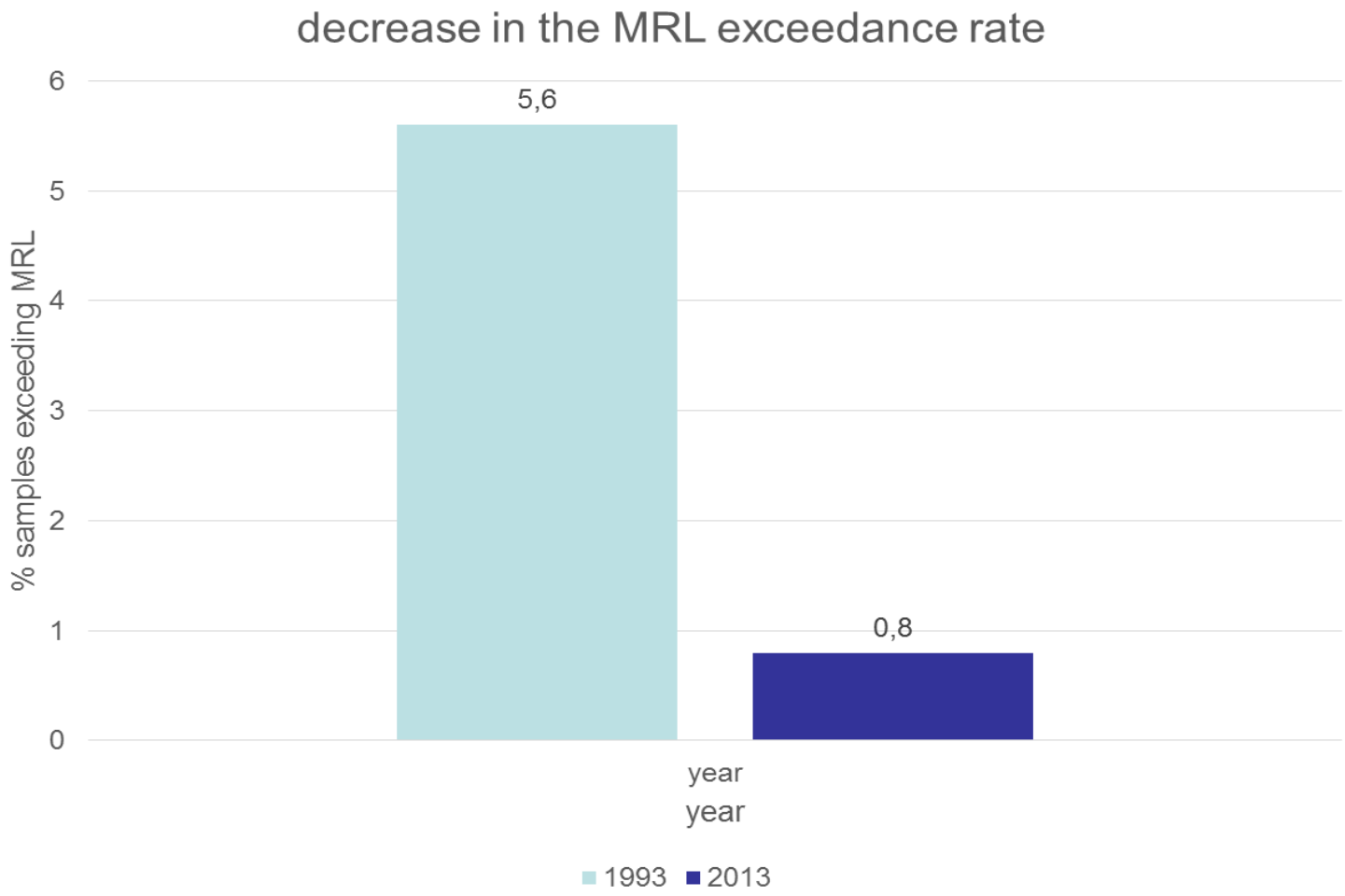
Nematods



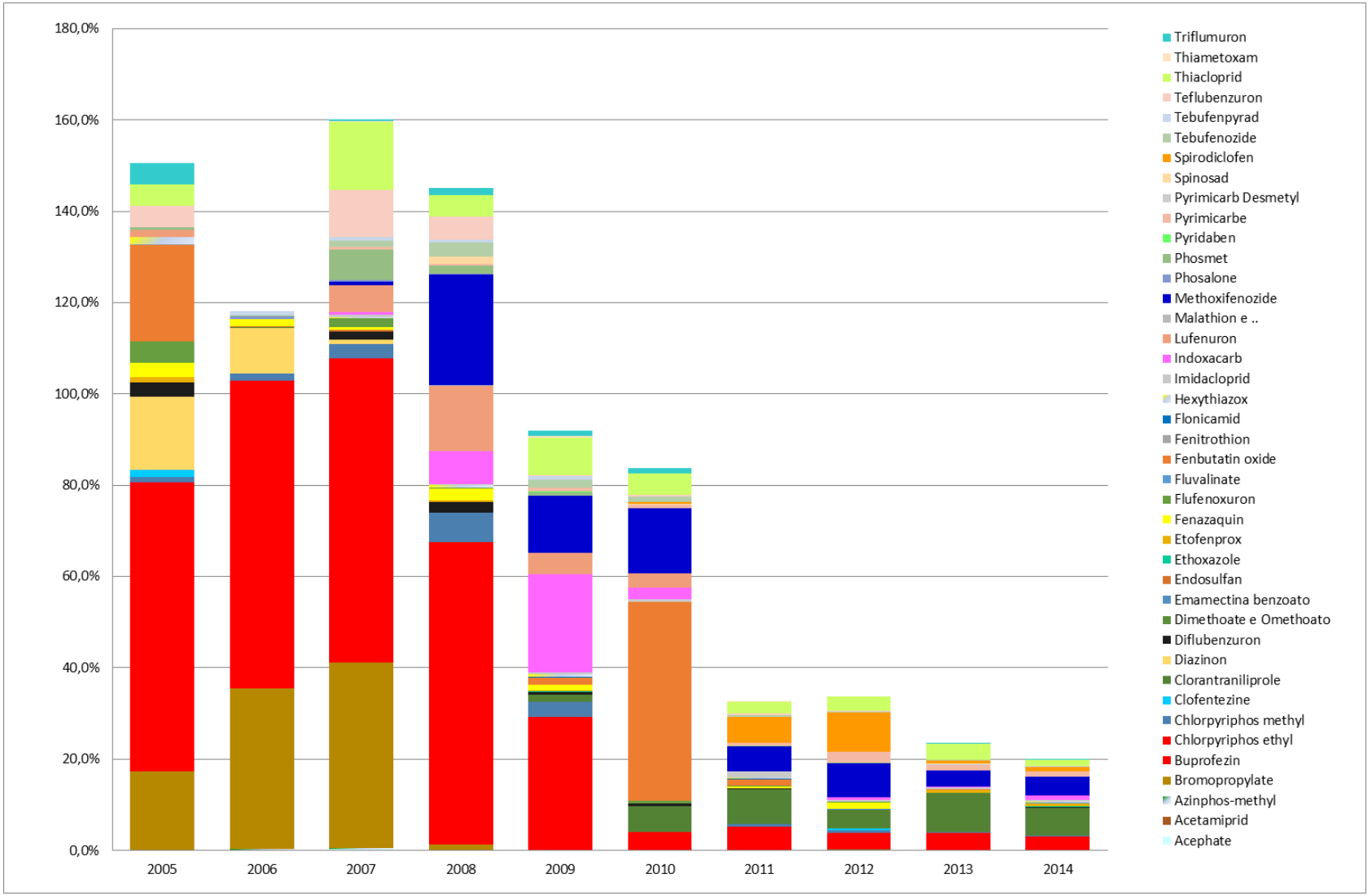
Forecasting models

spray technology

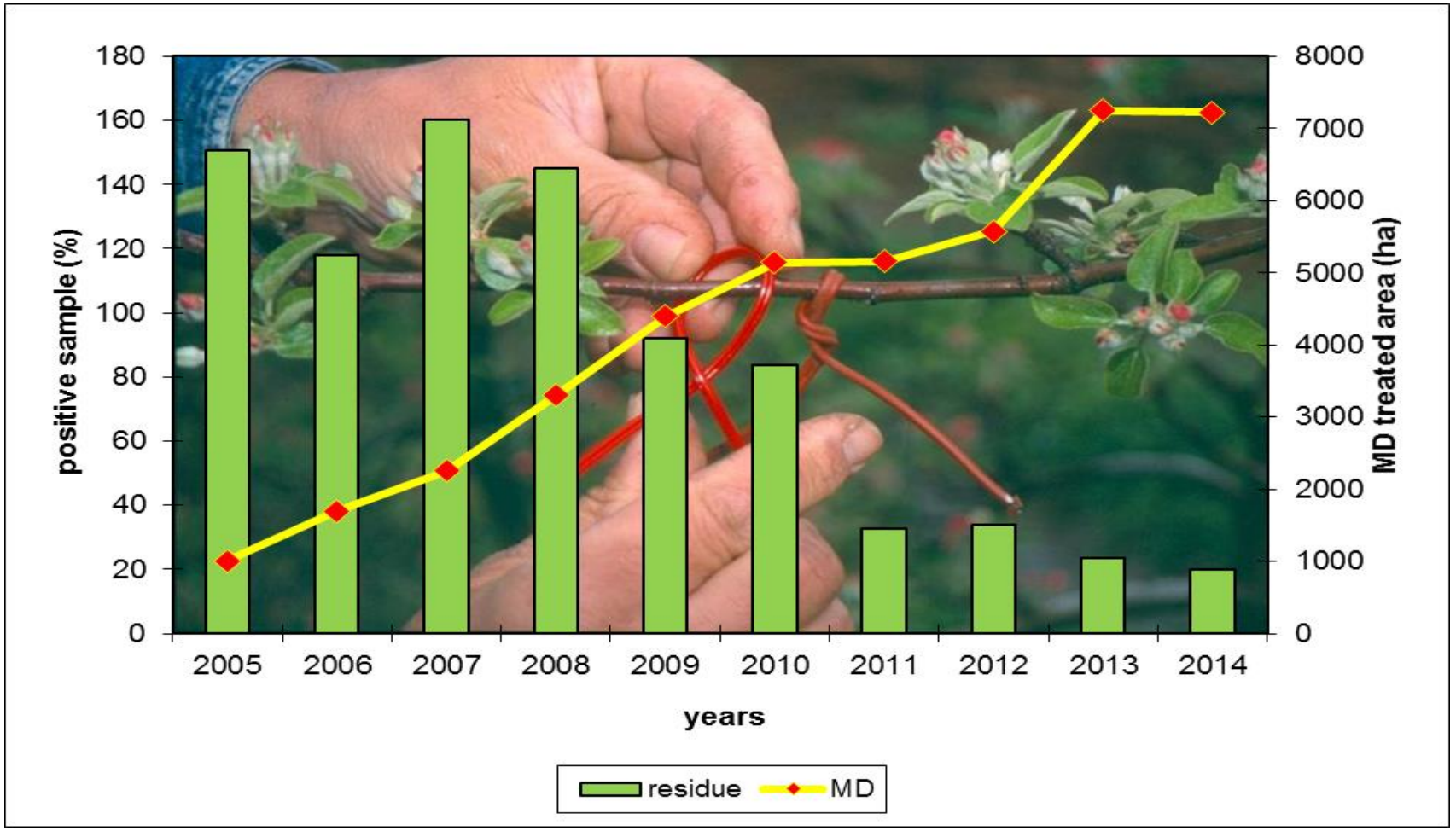
Consumer: pesticide residues issue



Consumer: pesticide residues issue

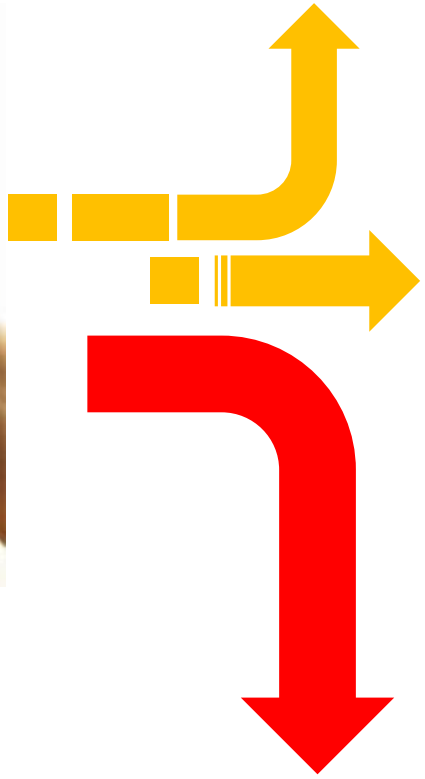


Consumer: pesticide residues issue



Environment: research challenge

- Environment Issues
  - Biodiversity erosion
  - Water and soil pollution
  - Greenhouse gas productio
  - Bystander pesticide exposition
- Crop needs
  - Invasive pests & emergent diseases
  - Soil fertility
  - Economic sustainability



New orchard architecture

THE TODAY'S SCENARIO OF APPLE INDUSTRY

In the last 30 years, yields have doubled from 35 to 70 tons/ha

Today the main goal is to increase economic and ecologic **sustainability** of the apple industry by:

1. Cutting down costs (less input of chemicals and labour)
2. Chosing more environmental benign techniques

Same yield with less input

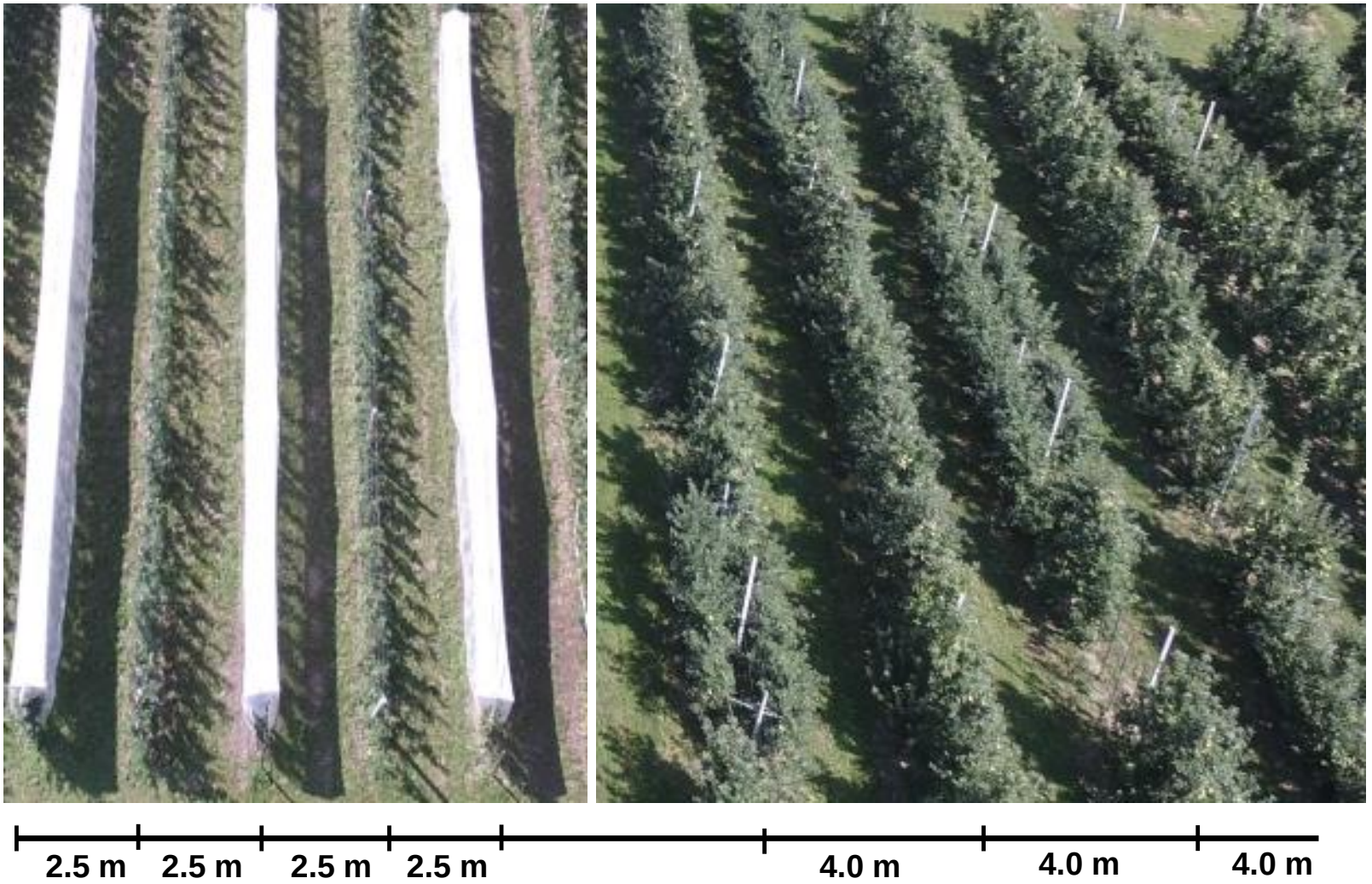
Can this be achieved by just changing

TREE ARCHITECTURE?

STUDYING TREE ARCHITECTURE

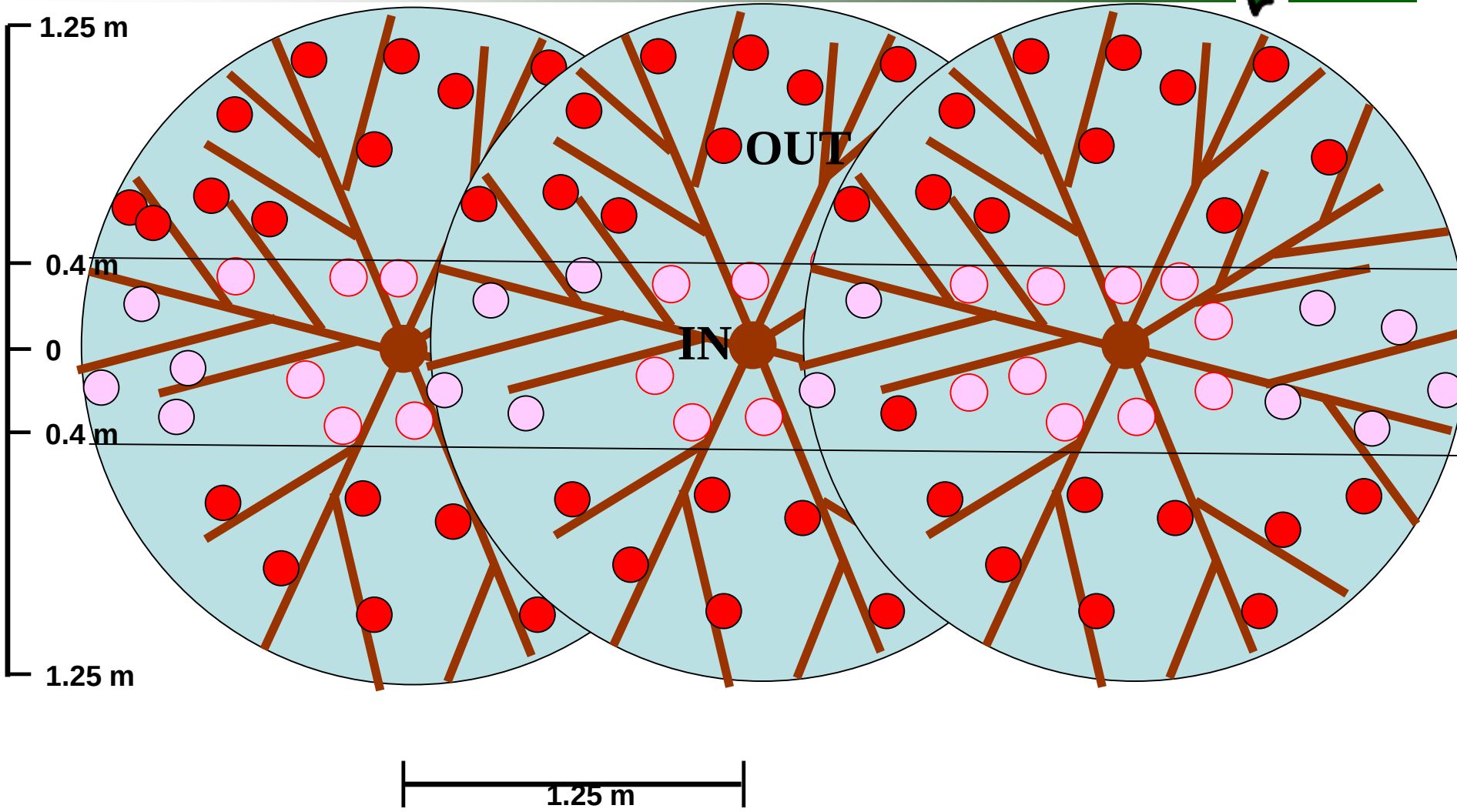
Multi-leader FRUIT WALL

TRADITIONAL



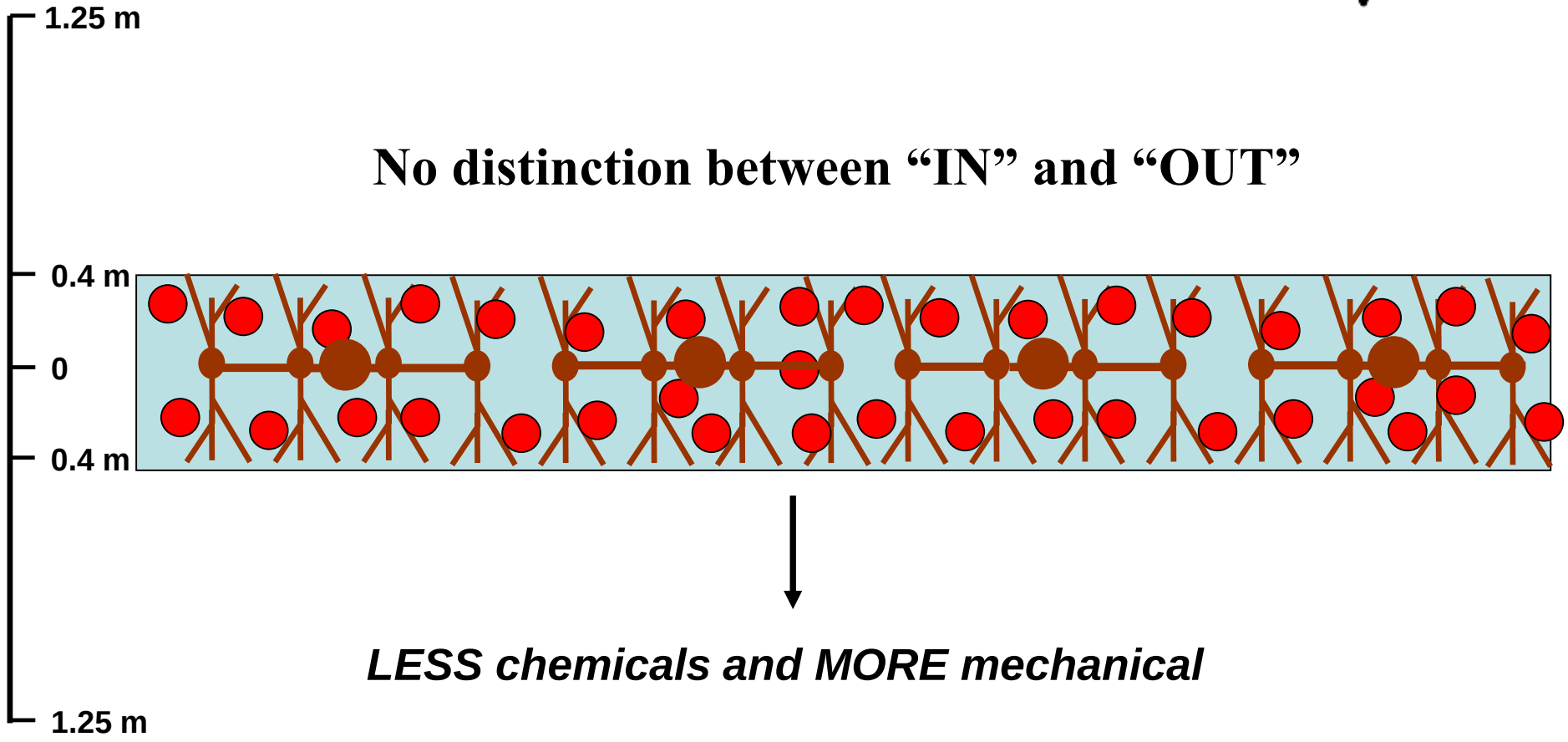
TRADITIONAL TREE ARCHITECTURE

(from above)



FRUIT WALL TREE ARCHITECTURE

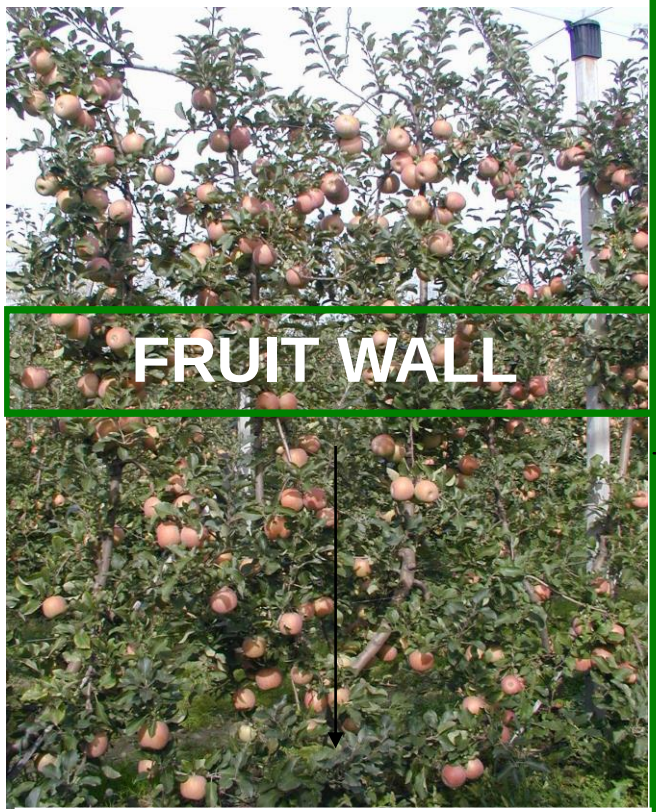
(from above)



No distinction between “IN” and “OUT”

LESS chemicals and MORE mechanical

Cultural practices improved by a FRUIT WALL



- Mechanical thinning
- Mechanical pruning
- Mech. weed control
- Less PGR's
- Less spraying volume
- Faster leaf drying
- Reduced drift
- Tunnel sprayers
- Multi-task nets
- SSCD

ECOLOGICAL ADVANTAGES
(physical/mech. tools)

Average treatment number against the main pests and problems in apple growing

Problem	N. Treatments
Scab	18
Cydia pomonella	2
Psylla	2
Aphis	2
thinning	3
growth control	2
weeds	3
drift	all treatm.

MECHANICAL THINNING OF FLOWERS

thinning ~~3~~

A branch after mechanical thinning

MECHANICAL PRUNING

growth control ~~2~~

Pedestrian orchard without use of plant growth regulators

TUNNEL SPRAYERS

drift ~~all treatm.~~

Tunnel sprayers on pedestrian multi-leader fruit wall can reduce drift and save up to 40% chemicals

MUTI-TASK NETS

Anti-rain net

Scab	~~18~~ → 4
Cydia pomonella	~~2~~
thinning	~~3~~
drift	~~all treatm~~

Untreated Golden D. apples

Control not covered
(99% scab)

2015

Covered by anti-rain net

(3% scab)

Multi-task nets can be effectively combined with tunnel sprayers

MECHANICAL WEED CONTROL

weeds	~~3~~

USE OF COVER CROPS

Clover sown under trees + mixture of grass species

weeds	~~3~~
growth control	~~2~~

FIXED SPRAYING on trellys under the nets opens up new possibilities (spraying m.o., organic compounds)

Scab	~~18~~
Cydia pomonella	~~2~~
thinning	~~3~~
drift	~~all treatm.~~

Pedestrian orchard under multi-task net

Many thanks for your attention