Pome fruit case study and orchard system

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FOOD QUALITY AND SAFETY

SIXTH FRAMEWORK PROGRAMME

endure diversifying crop protection

- 9 countries
  - BE, CH, DK, DE, ES, FR, IT, NL, SE
- 11 major European pome fruit production area

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- integrated control well established
  - corner stones
    - o spider mites – predatory mites
    - o pear psylla – predatory bugs
    - o wooly aphids – parasitoids and predators
    - o codling moth – mating disruption
    - o apple scab – warning system
- IPM practices known versus used
  - inventory on state of the art of IPM methods used
    - o questionnaire
    - o self expanding network
    - o analyses
- orchard system assessment
  - future development

- long history - non-the-less: high pesticide use
- a lot of questions
  - what tools are available?
  - to what extent used in practice?
  - bottlenecks
    - o why not used?
    - o economic, practical, technical
- 3 pomefruit problems with high pesticide demand
  - codling moth (*Cydia pomonella*)
  - apple scab (*Venturia inaequalis*)
  - brown spot of pear (*Stemphylium vesicarium*)

- warning systems (DSS)
  - further development
- pheromone disruption
  - RAK, Isomate
- virus
  - granulosis virus
- other techniques

- resistant cultivars
- warning systems (DSS)
  - Rimpro
  - further development ongoing
- sanitation
  - survival on fallen leaves
  - leaf shredding
  - urea
  - removing leaves from orchards
- antagonists
  - *Microsphaeropsis*

- *Stemphylium vesicarium*
  - problem since 1980th and increasing
  - north Spain, north Italy, Rhone valley France, Belgium, Netherlands
- leaf drop and fruit rot

- only “ready to use” IFP (IPM) methods
  - no method “still under development”
- get realistic data
  - sometimes easy, difficult
  - very variable: difficult to summarise
- judgement
  - lighter color: positive for integrated system
  - darker color: negative

IFP tool	no. regions	use in practice	obstacles
pheromone traps	all	5 – 100	none
monitoring damage S	all	1 – 100	none
monitoring damage H	all	5 – 100	none
corrugated cardboards	none	1	labour
dss – adults	90	100	none
dss – oviposition	90	90	none
dss – larval emergence	all	100	none
dss – generations	90	90	none
dss – thresholds	50	70	none

IFP tool	no. regions	use in practice	obstacles
non chemical			
sanitation	90	0 – 50	labour
mating disruption	100	25	labour, economic, practical
granulosis virus	90	10 – 100	practical
combinations	90	variable, low	labour, economic
chemical control			
priority IGR ´s	50	20	none
alternation IGR´s	80	80	none

> Summary brown spot of pear

IFP tool	no. regions	use in practice	obstacles
population monitoring	75	75 – 90	economic
decision support	all	5 – 100	none
sanitation	all	0 – 5	labour
non chemical methods	none	0	technical
chemical			
protectant fungicides	all	100	none
alternation	all	90	none
resistant cultivars	none	0	economic, practical

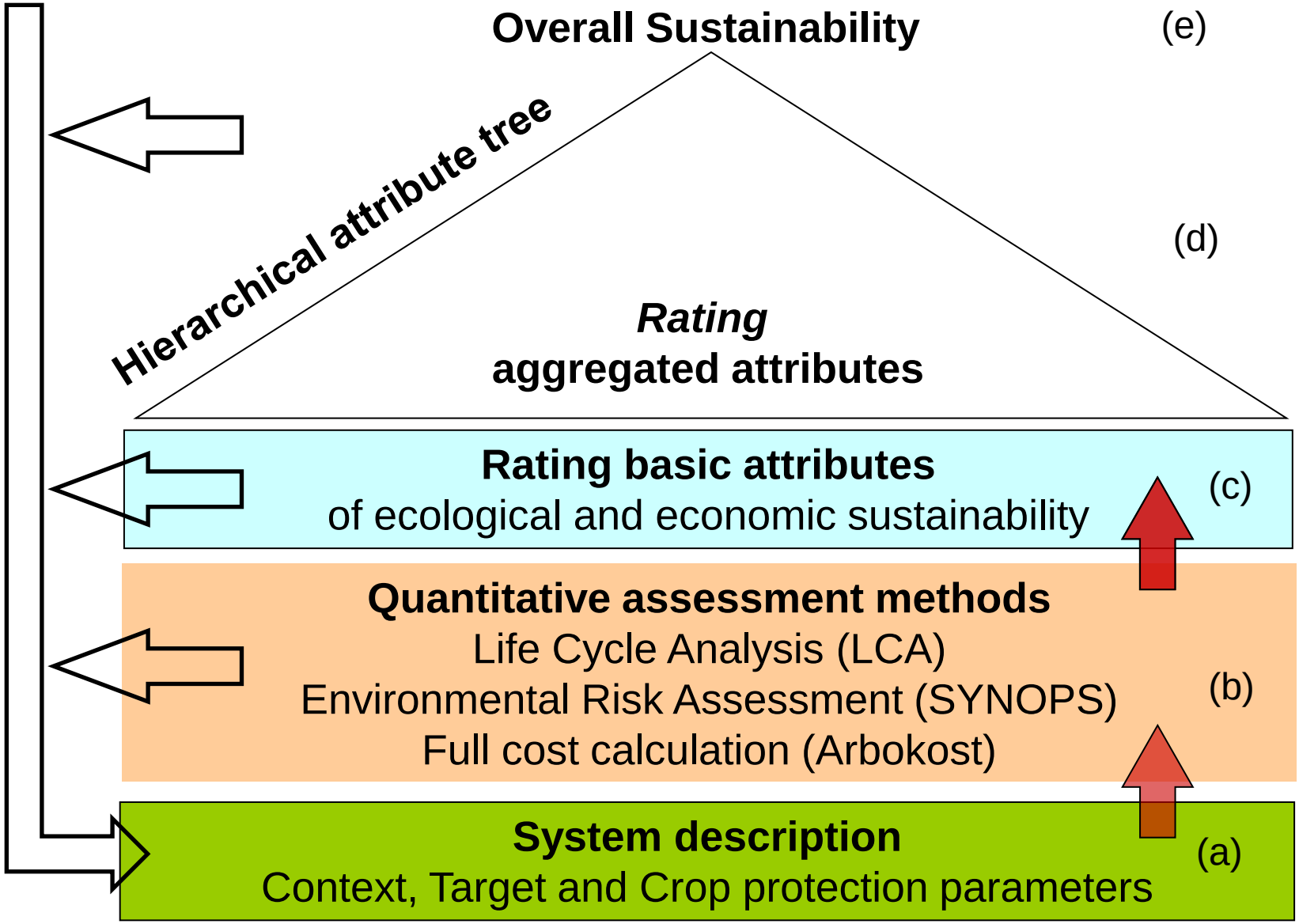
IFP tool	no. regions	use in practice	obstacles
cultural methods	50	0 – 10	economic, technical
monitoring	90	10 – 70	labour
decision support	all	50 – 100	none
sanitation	all	0 – 70	labour
chemical control			
protectant fungicides	all	100	none
alternation	all	90	none
resistant cultivars	none	0	none

> Conclusions questionnaire

- knowledge IFP methods: quickly and well spread
- spreading: governmental or private
  - extension services or advisors
- decision support systems: widely used
  - information by modern communication (SMS, e-mail, website)
- ready to use IPF tools: used everywhere in Europe
  - no differences between northern or southern regions
- resistant cultivars: not used!
  - except organic growers
- lack of selective pesticides
- registration of products is tedious and costly

- hindrances to implement: e.g. economic & labour
  - development: assessment methodology orchard systems

- directive 2009/128/EC « sustainable use of pesticides »
  - integrated pest management
    - careful consideration of all methods
    - discourage harmful organisms
    - keep intervention at economically and environmentally level
    - minimise risk to human health & environment
- Orchard system case study
  - goal:
    develop methodology to assess possible future orchard systems
    - in line with 2009/128/EC
    - quantitative


Overall Sustainability
(e)
Hierarchical attribute tree
(d)
Rating
aggregated attributes
Rating basic attributes
of ecological and economic sustainability
(c)
Quantitative assessment methods
Life Cycle Analysis (LCA)
Environmental Risk Assessment (SYNOPS)
Full cost calculation (Arbokost)
(b)
System description
Context, Target and Crop protection parameters
(a)

- 4 apple orchard systems defined
  - base line system (BS)
  - advanced system 1 (AS1)
  - advanced system 2 (AS2)
  - innovative system (IS)
- Base line system (BS)
  - good practices
    - o resistance management
    - o beneficial organisms
  - pesticides allowed in 2009
    - o only synthetic
  - common (susceptible) apple cultivars
  - no drift reduction other than 3 m buffer zone

- Advanced system 1 (AS1)
  - good and best practices
  - apple scab resistant cultivars
  - mating disruption (codling moth), more hail nets, predatory mites, bio control (e.g. fire blight), cover crop
  - pesticides with low ecotoxicity (more antagonists)
  - drift reduction: 45 % of area
- Advanced system 2 (AS2)
  - similar to AS1 + . . .
  - mechanical weeding, exclosure netting, natural fungicides after bloom - no residues
  - drift reduction: 80 % of area

- like AS2 + . . .
  - cultivars with multiple resistance
    - o apple scab
    - o powdery mildew
    - o fire blight
    - o aphids
  - new pesticides, with
    - o selective
    - o no effects on non target organisms

- contex parameters
  - overall quality parameters
  - orchard quality
  - infrastructure quality
  - drift reduction
  - decision support systems (dss)
  - labour
- target parameters
  - target yield
  - target price
  - impact on arthropods
  - impact on diseases
  - impact on beneficial organisms

- context parameters are region specific
  - no comparison possible between European regions
  - comparison between future orchard systems within a region
- basic quantitative information to describe and assess orchard systems
  - methods to control pests
    - o synthetic pesticides
    - o non chemical methods
  - date of application
  - dose
  - drift
  - etc.

> Example

Available alternative methodes	Options	BS chosen options	BS target organisms: codling moth	other lepidopteres	aphids	mites	other pests	AS1 chosen options	AS1 target organisms: codling moth	other lepidopteres	aphids	mites	Other pests
	1 mating disruption	-						x	x				
	2 attract and kill	-											
	3 sanitary methods	-						x	x	x			
	4 masstrapping	-						-					
	5 exclosure netting	-						-					
	6 EPN (Nematodes)	-						-					
	7 predators/parasitoids	-						x				x	
	8 resistent varieties/rootstocks	-						-					
	9 push and pull plants/cultivars (attractance and repellance)	-						-					

Insecticides / Acaricides	Options		compound per treatment: kg/l product per ha	% active ingredient	g a.i. per ha	BS treatments: *Number of applications*	*calandar week*	g AI per ha and season	BS target organisms: codling moth	other lepidopteres	aphids	mites	Other pests	AS1 treatments: *Number of applications*	*calandar week*	g AI per ha and season	AS1 target organisms: codling moth	other lepidopteres	aphids	mites	Other pests
	1 pheromones	codlemone a.o.			0									1	16	0	x				
	2 granulovirus				0																
	3 IGR's (moulting inhibitors)	novaluron	0,96	10%	96	0,5	22	48	x	x											
	4 IGR's (ecdysone mimics)	methoxyfenozid	0,64	24%	153,6	1	27	153,6	x	x				0,33	22	50,688	x	x			
	5 IGR's (Jh mimics)	fenoxycarb	0,96	25%	240	0,5	20	120	x	x				0,33	20	79,2	x	x			
	6 various	Indoxacarb	0,27	30%	81	1	31	81	x	x				0,33	25	42	x	x			
	7 neonicotinoids	flonicamid	0,16	50%	80	1	25	80			x			1	17, 25	80			x		
	8 neonicotinoids	thiacloprid	0,32	40%	128	1	20	128			x		x	1	20	128			x		x
	9 organophosphates	chlorpyrifos-ethyl	2,4	23%	552	0,5	17	276		x			x								
	10 acaricides	tebufenpyrad	0,32	20%	64	1	20	64				x									
	11 oil		32	95%	30400	0,25	12	7600			x	x	(x)	0,33	12	10032			x	x	
	12 novel insecticide without non-target effects		?	?	?																
	Necessary number of sprays (drive trough orchard)					*2*								*1*							

PRAKTIJKONDERZOEK PLANT & OMGEVING
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endure diversifying crop protection

- parameters chosen
  - adequate to describe apple orchard systems
  - useful for quantitative data collection
  - collected data
    - o can be changed for different situations/conditions, European regions
    - o are valid now, but should be renewed, if an assessment is made e.g. 10 years from now
- results
  - apple orchards
  - can be adapted for other crops (PURE)
  - direct policy makers and decision makers
  - detailed results in next presentations