Sustainability assessment of future orchard systems

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FOOD QUALITY AND SAFETY

SIXTH FRAMEWORK PROGRAMME

endure® diversifying crop protection

- 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

- 5 countries
  - CH, DE, ES, FR, NL
    - 2009 - 2010

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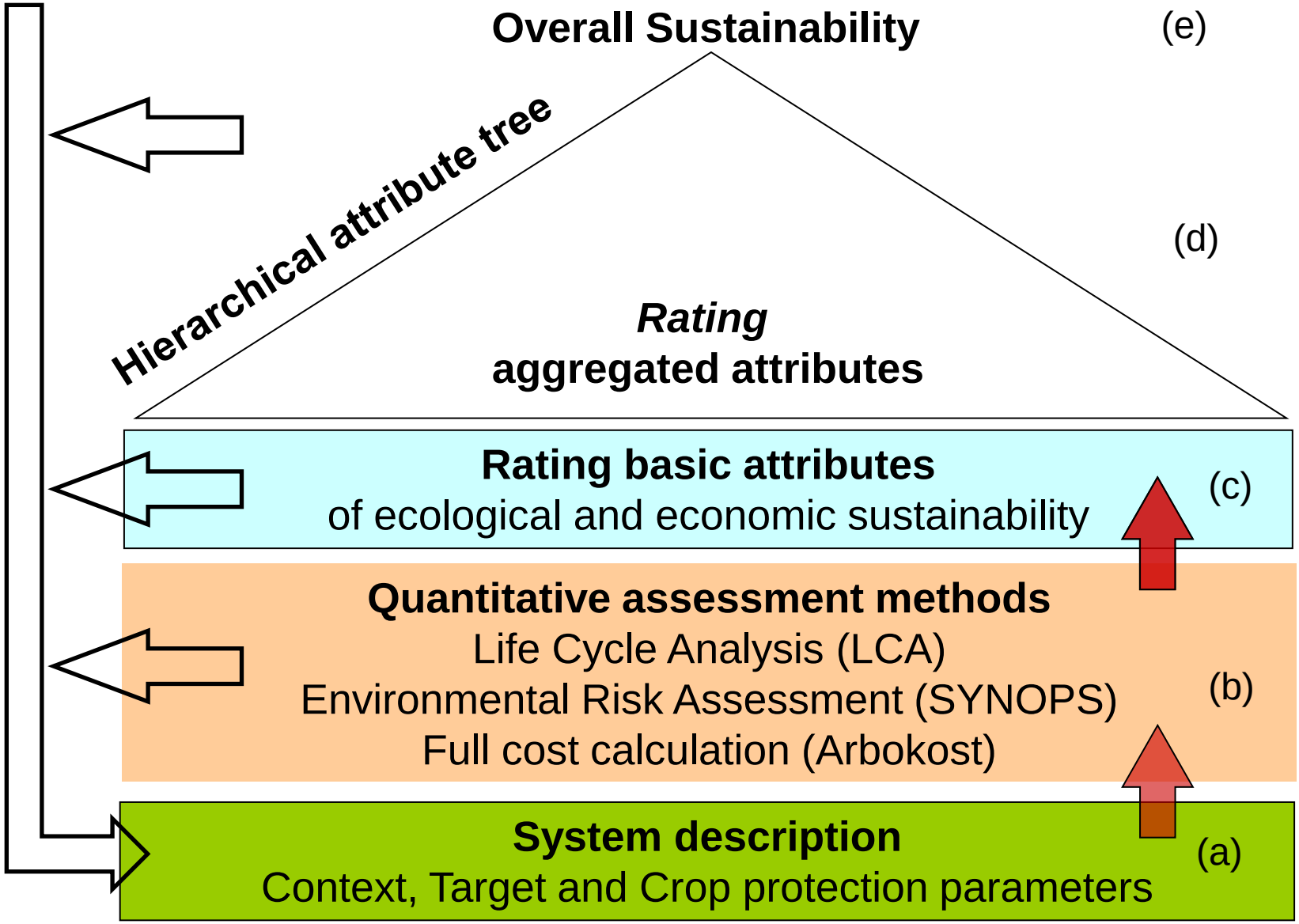
Overall Sustainability
(e)
Hierarchical attribute tree
(d)
Rating
aggregated attributes
Rating basic attributes
of ecological and economic sustainability
(c)
Quantitative assessment methods
Life Cycle Analysis (LCA)
Environmental Risk Assessment (SYNOPS)
Full cost calculation (Arbokost)
(b)
System description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

- overall quality parameters
  - overall pest management, regional climate, landscape elements, regional pest pressure, soil quality, ecological compensation area
- orchard quality
  - cultivar mixture, training system, orchard size, vigour, pest pressure, fertilisation, mulching between rows, % area under weed control
- infrastructure quality
  - irrigation system, storage, post-harvest treatment, tractor used for spraying
- drift reduction
  - hail net, hedges, drift reducing sprayers
- decision support systems (dss)
  - dss types used, decision making and monitoring
- labour
  - application quality, education and training

> Target parameters (31)

- target yield
  - total yield, variability, dramatic yield, portion 1st class, industry, lost
- target price
  - price of 1st class, second class and lost fruit
- quality for resistance management
  - maintenance of resistance, tolerant cultivars, minimising resistance to pathogens and arthropods
- impact on arthropods
  - overall impact on arthropod pests, codling moth, other lepidoptera, aphids, mites, other pests
- impact on diseases
  - overall impact on diseases, apple scab, powdery mildew, fire blight, storage diseases, others e.g. calyx rot, fruit tree canker
- impact on beneficial organisms
  - overall impact on arthropod pests, predatory mites, earwig, Coccinellidae, parasitic hymenoptera

- 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
WAGENINGEN UR

endure diversifying crop protection

- 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

- 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