Economic Assessment of crop protection strategies in apple production

Gabriele Mack
Agroscope, Switzerland

FOOD QUALITY AND SAFETY

SIXTH FRAMEWORK PROGRAMME

endure diversifying crop protection

Aim of the economic study

1. To provide a method for the economic assessment of crop protection strategies, which can be adapted to specific regional conditions.
2. To provide economic estimations for sustainability assessments of crop protection strategies, which at the end allow elucidating the optimal conditions for the implementation of innovative and durable cropping systems.
3. To assess potentially innovative and futuristic methods of crop protection, which are needed towards identifying the driving forces of innovative crop protection systems.

Economic criteria for the assessment

- **Crop profitability**

- Crop profitability is meant to evaluate the economic efficiency of the orchard system in securing grower's incomes.

Attributes

- Total production cost per kilogramme 1st class apple
- Family income per labour hour
- Net profit per hectare

Full cost calculation

Total production cost = Direct cost + Structural cost

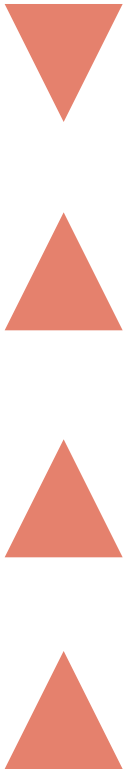
Direct cost = Fertilisers + Pesticides + Irrigation + Contribution to grower's cooperative + Orchard depreciation + fruit packing

Structural cost = Cost for buildings + Operation of machinery + Irrigation operations + Interest on capital + Labour cost (family and non-family labour)

Tool of Agroscope Switzerland (Arbocost) available on the internet

Expected changes of total production cost

- **From baseline to advanced systems**
  - o Cost for synthetic chemicals including machinery cost for application decrease
  - o Cost for alternative plant protection measures (e. g. non-chemical mechanisms and innovative products) increase
  - o Cost for protective measures increase (more hail nets)
  - o Labour cost (e. G. pheromons, time for plant protection monitoring) increase



Expected changes of total production cost

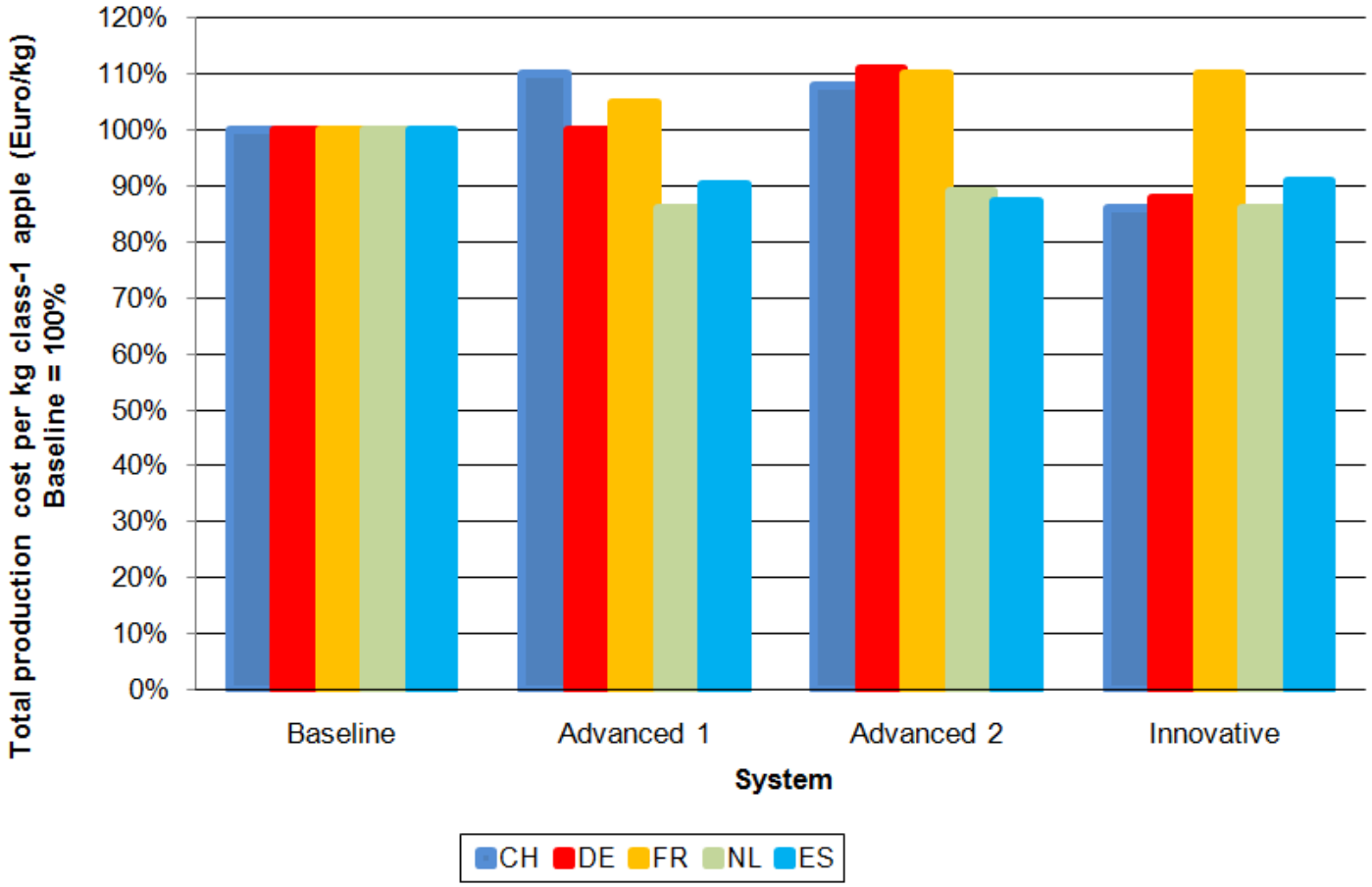
- From advanced to innovative systems
  - o No additional cost for or non-chemical mechanisms and innovative products are assumed
  - o No additional costs for protective measures (hail nets) are assumed

Expected changes of revenues

- From baseline to advanced systems
  - o Yields
    - No change: ES, D, CH, F
    - Increase: NL
  - o Quality
    - No change: D, CH
    - Increase: NL, ES, F
- From advanced to innovative systems
  - » Yields increase (D, CH, NL)
  - » Quality increase (NL, ES, CH)

Expert estimations
Prices assumptions for all systems are equal

How are production costs per kg affected?



endure diversifying crop protection

Farm autonomy criteria

- Measurement of the economic viability in the long-run

- **Attributes**
  - Invested capital per hectare = cash flow at the end of the 3rd year

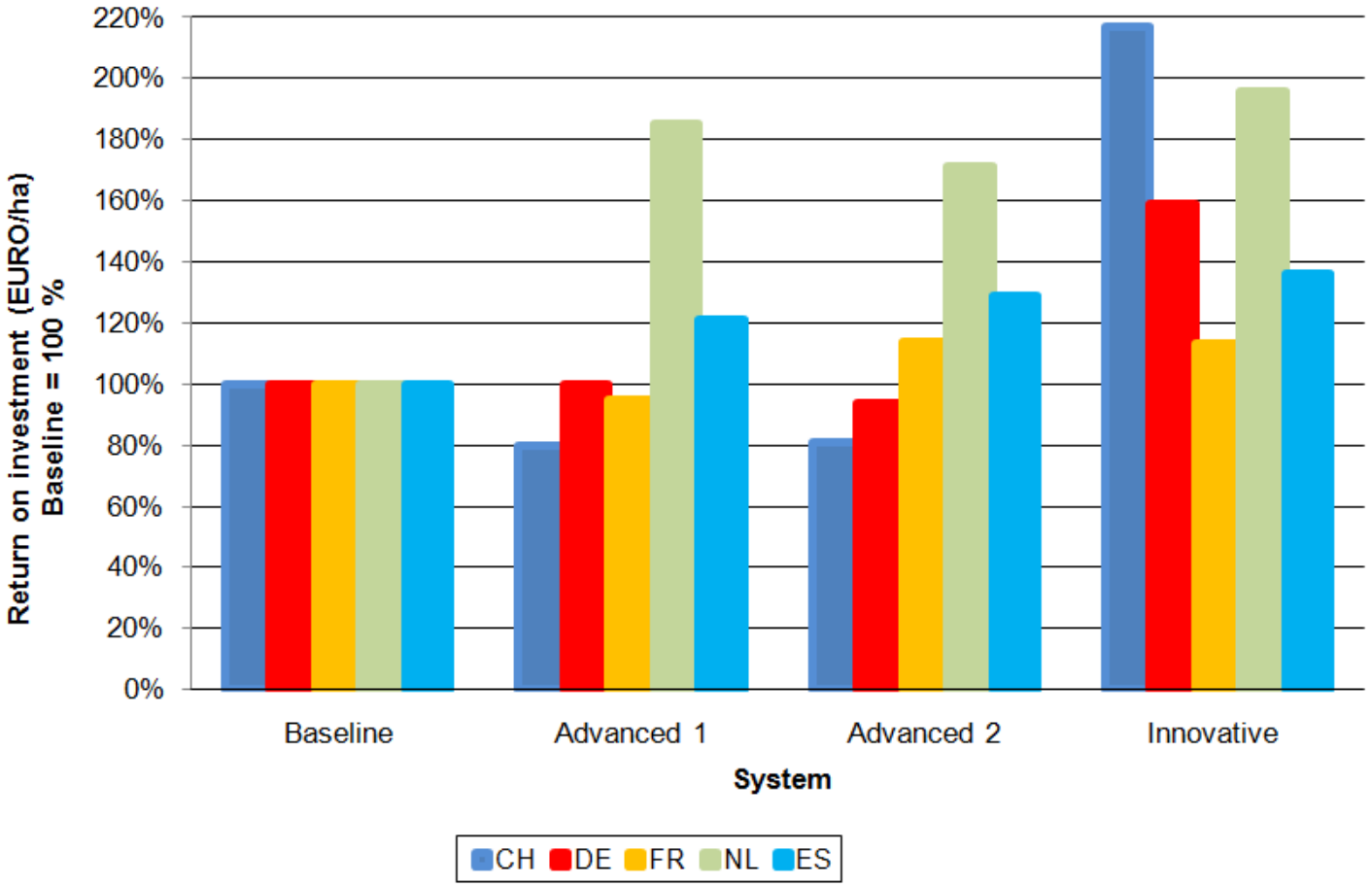
    (establishment costs + Σ (net profit) $_{1\text{-}3\ year}$)

  - Return on investment =

    (net profit + interest on capital) / invested capital

    - Interest on capital = interest rate × invested capital

Return on Investment



Income risk criterium

- The risk related to income variability is defined by the potential costs or benefits that the instability in crop production and in fruit quality may cause.

- **Attributes**

  - Family income variability per hectare
  - Probability of dramatic yield loss in 10 years

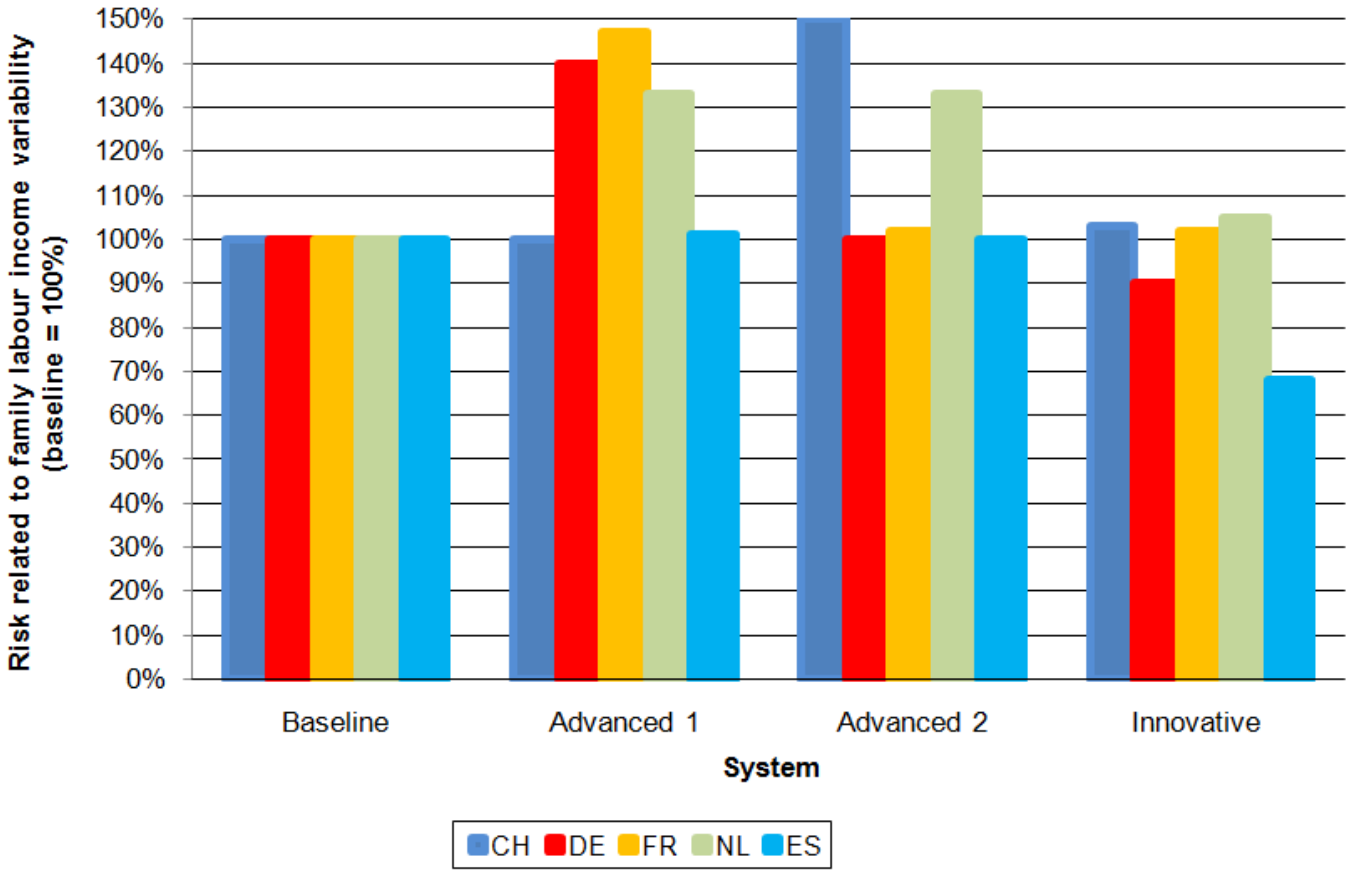
Expected changes of variability

- **From baseline to advanced systems**
  - o Yield variability
    - *No change (ES)*
    - *Increase (D, CH, NL)*
  - o Fruit quality variability
    - *No change (NL, D, CH, ES)*
- **From advanced to innovative systems**
  - » Yield variability
    - *No change (D)*
    - *Decrease (ES, CH, NL)*
  - » Fruit quality variability
    - *No change (ES, D, NL)*
    - *Decrease (CH)*

Risk calculation

			System			
	Name	**Units**	Baseline **(BS)**	Advanced **(AS1)**	Advanced **(AS2)**	Innovative **(IS)**
Family labour income	**FI**	EUR/ha	Arbokost	Arbokost	Arbokost	Arbokost
Upside variation	**U**	EUR/ha	↑Y, ↑S	↑Y, ↑S	↑Y, ↑S	↑Y, ↑S
Downside variation	**D**	EUR/ha	↓Y, ↓S	↓Y, ↓S	↓Y, ↓S	↓Y, ↓S
Potential variation	**VI**	EUR/ha	BS (U – D)	AS (U – D)	IS1 (U – D)	IS2 (U – D)
Risk related to variation (baseline 100%)		%	BS (VI) / BS(VI)	AS (VI) / BS(VI)	IS1 (VI) / BS(VI)	IS2 (VI) / BS(VI)

Potential family labour income variation



endure diversifying crop protection