



Designing innovative winter crops based cropping systems

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FOOD
QUALITY
AND
SAFETY



Integrated Pest Management in Europe

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Why redesign cropping systems?



- There is strong economic and strategic need to control pests
- But also strong socio-political and environmental pressure to limit pesticide usage

What constitutes a cropping system?

- Crops and their sequence
- Season of cropping
- Crop management
 - including crop protection measures

All these can influence pesticide use



Winter crops in Denmark, England & France

- Winter wheat, winter oilseed rape & winter barley
 - o **Denmark**, 2008 figures
 - 35% of the total arable area
 - Winter wheat composed 42% of the small grain cereals
 - o **England**, 2007 figures
 - 69% of the total arable area
 - Winter wheat covered 64% of the small grain cereals
 - o **France**, 2007 figures
 - 65% of arable crops
 - Winter wheat composed 56% of the winter crops

Redesigning cropping systems

– **Alternative systems (AS)**

- o Currently available technologies
 - Integrated pest management systems
 - Organic cropping
- o Tested, knowledge of effects in cropping system
- o Ready-to-use



– **Innovative systems, level 1 (IS1)**

- o Existing technologies
- o Not yet tested in cropping systems

– **Innovative systems, level 2 (IS2)**

- o Look into the future, 10-20 years ahead
- o Developing technologies
- o Predict performance in various future scenarios (as defined by ENDURE foresight study)

The Danish approach

– Current system

- o Intensive crop and pig producers
- o Strong reliance on pesticides
- o Strenuous crop sequences
- o Major pest problems
 - Annual grass weeds and cleavers
 - Weevil, pollen beetle, aphids
 - Rust, mildew, septoria, net-blotch

– Non-negotiable requirements:

- o Secure the supply of forage grain
- o Comply with crop preferences
- o Economically feasible

Danish pesticide consumption is already low





Current crop sequence:

w barley – w rape – w wheat – w wheat

AS and IS1 crop sequence

w barley – w rape – w wheat - w wheat + catch crop – s barley + catch crop – s barley

AS tools

- Inversion tillage
- Stubble cultivation
- Choice of variety
- Sowing time
- Row cropping of oilseed rape

IS1 tools

- Farm logistics
- Precision technologies (GPS)
- Breeding programmes
- Trap cropping
- Application, forecasting, decision support

TFI-current: 2.5 → TFI-AS: 1.68 → TFI-IS1: 1.57

The UK approach

– Current system

- o Intensive arable
- o Major pest problems
 - black grass (resistance), bromes
 - aphids/virus, flea beetle, pollen beetle (resistance), slugs
 - *Septoria* (resistance), yellow rust, *Phoma*, light leaf spot, *Sclerotinia*

– Non-negotiable requirements:

- o Maintain yields and farm incomes

– Crop protection strategy:

- o Pesticides and cultural control (e.g. cultivations, sowing date, crop rotation)





Current crop sequence:

w wheat - w wheat/w barley - w oilseed rape

AS crop sequence

w wheat – s beans –
w wheat – s barley – w rape

AS tools

- lengthening rotation
- pesticide targeting and resistance management
- diversifying crops
- minimising tillage where possible
- conservation biological control
- resistant cultivars

IS1 crop sequence

w wheat – s beans – s barley
– w rape

IS tools

- lengthening breaks between wheat crops
- greater proportion of spring crops
- precision farming
- trap cropping
- rape on wide rows
- landscape management

TFI-current: 6.2 \longrightarrow TFI-AS: 3.8 \longrightarrow TFI-IS1: 2.7



The French approach

– Current systems

- o Intensive cropping systems, low proportion of non-productive areas in the regions considered
- o Strong reliance on pesticides (TFI 5.8-7.1)
- o Major pest problems:
 - Autumn weeds in cereals
 - Stem weevil & pollen beetle in WOSR, aphids in cereals
 - *Septoria* in cereals, *Sclerotinia* in WOSR

– Characteristics of the farms considered

- o Equipped for mechanical weeding
- o Opportunity to sell forage crops for cattle livestock



Current crop sequence:

w rape – w wheat – w barley

AS crop sequence

w.rape-w.wheat-w.barley-
(legumes)-sunflower-w.wheat

AS tools

- Diversify crop rotation
- Use of resistant cultivars against diseases, cultivar mixtures
- Diversify sowing periods (spring crops and sowing dates)
- Mechanical weeding and stale seedbed

IS1 crop sequence

W.rape-w.wheat-s.barley-
alfalfa-alfalfa-w.wheat-
(mustard)-sunflower-
triticale

IS1 tools

- Enhanced use of AS tools
- Landscape management
- Biological control (e.g. Contans®)

TFI-current: 5.8 – 7.1 \longrightarrow TFI-AS: 2.2 \longrightarrow TFI-IS1: 0.4

Conclusions

Farm level

- Considerable scope for pesticide reduction
- Improved environmental sustainability in the UK and French proposals
- Different local contexts, constraints and priorities led to different approaches to pesticide reduction:
 - o **UK and DK:** Modifying existing systems
 - o **France:** Developing systems from a zero pesticide scenario



National or European level considerations

- Full socioeconomic and environmental analysis needed
- Implications for markets, prices, food security
- Policy instruments for implementation

http://www.endure-network.eu/endure_publications/deliverables (DR 2.16)

Developing higher level innovative cropping systems (IS2)



– Objectives

- o Look further ahead, 10-20 years, to the development of higher level innovative systems
- o Identify immature technologies that could contribute to pesticide reductions
- o Help to define long-term research priorities

– Methodology

Workshop with relevant experts:

- o Address the 5 future scenarios described by the ENDURE Foresight study
- o Identify innovative technologies relevant to each scenario
- o Highlight technologies with the most robust potential across all scenarios

http://www.endure-network.eu/endure_publications/deliverables (DR 2.24)