

# Designing innovative winter crops based cropping systems

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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





#### Innovative cropping systems: The Danish approach

#### **Current crop sequence:**

w barley - w rape - w wheat - w wheat



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:
  - 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 — TFI-AS: 3.8 — 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.barleyalfalfa-alfalfa-w.wheat-(mustard)-sunflowertriticale

#### **IS1 tools**

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

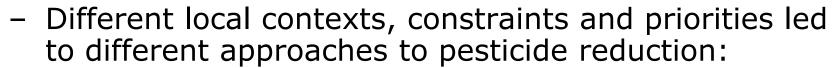
TFI-current: 5.8 – 7.1 → TFI-AS: 2.2 → TFI-IS1: 0.4



#### **Conclusions**

#### **Farm level**

- Considerable scope for pesticide reduction
- Improved environmental sustainability in the UK and French proposals



- 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

- 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
- 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)





