

# COST 734

## WG4 – Model intercomparison

# Model comparisons

- Main indicators: phenology, yield, quality, aboveground biomass, (potential yield)
- Additional indicators for interpretation
- Compare simulated results to data from experiments
  - Usual statistics: MBE, RMSE, model efficiency
- Compare simulated results with varying temperature, summer/winter precipitation, and changes in interannual variability in temperature and rainfall
  - Response surfaces to changes in temperature, rainfall and variability at different sites
  - Few climate change scenarios
  - Three sites
  - Two soils
- No analyses of CO<sub>2</sub> effects
- Crops: winter wheat and spring barley

# Data for model testing

- Data since 1980
- Denmark
  - Variety trials for winter wheat and spring barley
- Czech Republic
  - Variety trials for winter wheat and spring barley
- Germany
  - Müncheberg trial with/without irrigation
- Poland
  - Agricultural systems experiment Pulawy
- Italy
  - Field experiment, durum wheat
- Finland
  - Variety trials for winter wheat and spring barley

# Models

- CERES - Mirek
- WOFOST - Reimund
- FASSET - Jorgen
- HERMES - Christian
- Daisy - Jorgen
- CropSyst – Donatelli??
- STICS – Emmanuel
- APSIM – Jorgen. Holger Meinke ?

# Data needs

- Soil
  - Soil profiles (layers) of texture, C, N, soil water retention curve, hydraulic conductivity
- Crop management
  - Previous crops (preferably 2 years) and N fertilisation
  - Variety, sowing and harvest dates, fertilisation, tillage, irrigation, mulching, seed rate
- Main indicators
  - Crop yield, protein content, grain weight, date of emergence, heading, anthesis and maturity
- Supplementary indicators
  - Growth analysis (dry matter and N uptake), soil water and soil mineral nitrogen, diseases etc.
- Data management
  - Standardised Excel spreadsheets?
- Responsible for drafting data standard: Christian

# Model comparison with experimental data

- Model calibration
  - Crop phenology only
- Model runs
  - Use spin-up period as required by individual model
- Model output
  - Main indicators: yield, protein, grain weight, growth stages
  - Additional daily indicators: LAI, aboveground dry matter + N, soil mineral N, soil water at 0-30, 30-100 and 100-200 cm, evapotranspiration, drainage
- Model performance criteria
  - **RMSE, MBE, ME, Index of agreement, Nash-Suttcliff, Wilmot**
  - **How to deal with trends in yield**
- Responsible for drafting protocol: Reimund

# Model comparison with response surfaces

- Which sites and soils?
  - 3 sites: Denmark, Czech, Italy
  - 2 soils: loamy sand, loam
  - Weather generator: Marwin
- Which responses:
  - Temperature: -1 to 5 C
  - Winter and summer rainfall: -50 to +50 %
  - Increased variation: normal, 1½, 2 x STD of temp, rainfall, duration of dry periods
  - 3 scenarios (2050, 2080)
- Adaptation
  - Non-limiting nitrogen. Sowing date (let CERES decide)
- Model output
  - Main indicators: yield, protein, grain weight, growth stages
  - Additional daily indicators: LAI, aboveground dry matter + N, soil mineral N, soil water at 0-30, 30-100 and 100-200 cm.
- Responsible for drafting protocol: Jörgen

# Outcome

- Refereed papers:
  - Ability of a range of crop models to capture observed interannual and site dependent variation in cereal yield (and quality?) (????)
  - Comparison of cereal crop model responses to changes in temperature and precipitation (????)
  - Analysis of extreme years (Pirjo)
  - Response of national cereal yields to variation in temperature and rainfall (Mirek)
  - Agriclim study (Mirek)