## BIOLOGY AND MANAGEMENT OF CROP PESTS

Major external project grants (coordinator og WP leader)

- IWMPRAISE (Horizon2020)
- IPM Decisions (Horizon2020)
- RELIUM, EURO-RES, SpotIT, DDSBlight2.0, IPM4Meligethes (C-IPM)

- BlightManager (GUDP)
- HORTPROTECT (GUDP)
- Green Christmas (GUDP)
- LUGEROBOT (GUDP)
- Microbial products in IPM strategies (Danish Environmental Protection Agency)
- RoboWeedMaPS (Innovation Fund Denmark)



# CROP HEALTH RESEARCH SECTION

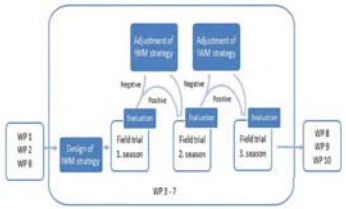
## PER KUDSK, SECTION MANAGER



## IWMPRAISE

The main objective of IWMPRAISE is to demonstrate that adoption of IWM will support cropping systems that are agronomically and environmentally more sustainable and more resilient without jeopardizing profitability or the steady supply of food, feed and biomaterials.

37 partners (National clusters)







## FEATURES OF THE CROP HEALTH SECTION

Most diverse of the six research sections

- Biology and management of crop pests ("Sustainable pest management" flagship)
- Seed science and technology
- Natural product chemistry and environmental chemistry

Financially we stand on three legs

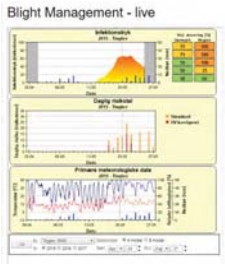
- Research projects
- Policy support (pesticide use, IPM, pesticide efficacy evaluation and seeds)
- Collaboration (bilaterally) with private companies ("commercial activities")

# LUGEROBOT (ROBOTIC WEED HOEING)

Collaboration with the SMEs
Agrointelli and
Frank Poulsen Engineering



# BLIGHTMANAGER




BlightManager will improve decision support through the use of local weather stations (regional to local), robot technology for early identification of diseases and better use of host resistance.

Collaboration with the potato starch industry, advisory services and SMEs.



# SEED SCIENCE AND TECHNOLOGY

**Major challenges in herbage seed production**

- New varieties are bred for optimised vegetative production, which often compromises the reproductive development
- Product quality requirements are very high while crop protection methods are often limited

**Research objectives**

- Investigate physiological aspects of the balance between vegetative and reproductive growth
- Develop tools to estimate crop growth and development (models and AUV)
- Characterise seed yield components and their interaction
- Develop integrated pest management strategies for improved crop yield and product quality
- Improve seed germination, vigour and longevity

**Financing**

- Primarily through a long-term and committed collaboration with the Danish seed industry



# HORTPROTECT

Strip tillage in field vegetables

Fungicide resistance in *Botrytis cinerea*

Performance of microbial products

Trap crops for *Meloidogyne hapla*

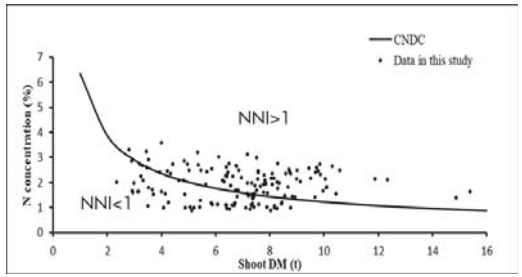
# IPM STRATEGIES: GRASS WEED CONTROL IN TURF GRASS SEED PRODUCTION

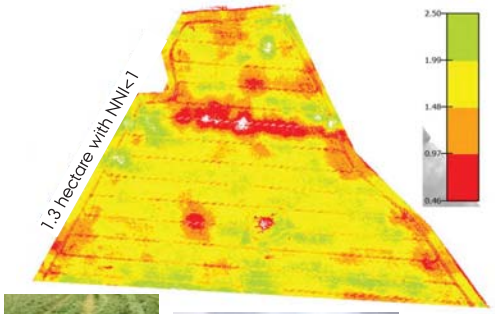


- Identification of control measures for weeds (monocots in grass seed / dicots in vegetable seed production)
- Improved knowledge about the biology of weeds
- New establishment techniques with cover or catch grops



# NITROGEN REQUIREMENT FOR OPTIMAL SEED PRODUCTION




Reducing vegetative development by split nitrogen application based on Critical Nitrogen Dilution curve




# INSECT PESTS – BIOCONTROL IN WHITE CLOVER

*Hypera meles*

*Protapion* spp.

Untreated control: Yield loss 40%

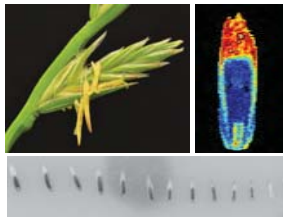
Natural enemies (*Bathyplectes curculionis*) identified in the harvested material. Processed and placed in field borders. Strategies for biocontrol strategies in organic farming /combined with chemical control in conventional production


Biocontrol strategies in white clover for seed production, The Danish Environmental Protection Agency



# PLANT GROWTH REGULATION

- Potential versus realised seed yield
- Plant growth regulators
  - Different active ingredients tested
  - Application time and dose
  - Interactions with plant growth regulation and development
- Seed yield increased by 20-30%
- Activities carried out in collaboration with Seges, seed growers and the seed industry (Research program Seed Production, GUDP)

## NATURAL PRODUCT CHEMISTRY AND ENVIRONMENTAL CHEMISTRY
### CEREAL BENZOXAZINOIDS (BX) IN RELATION TO CROPS AND ENVIRONMENT

- BXs transform into a broad range of hitherto unknown metabolites in soil
- The BX DIMBOA inhibits mycotoxin production through inhibition of *Tri6*
- Maize-synthesized BXs affect the host associated microbiome – many plant pathogens correlate negatively with BX content

- **FUTURE RESEARCH**
- Search for similarities in signaling processes of BXs across plants and mammals
- Elucidate auxin-like effects of selected BX



## EXTENDING SEED SCIENCE AND TECHNOLOGY INTERNATIONALLY

- Working with 11 CGIAR genebanks to improve genebank operations in relation to seed quality management
  - Reviewing genebank procedures and data
  - Research collaboration
  - Capacity building and student supervision
- Part of the CGIAR Genebank Platform (administered by the Crop Trust)

**Future need:**

- For both basic seed science expertise and research, and more fundamental research to meet new expectations for seed testing and processing for more sustainable crop production



## NATURAL PRODUCT CHEMISTRY AND ENVIRONMENTAL CHEMISTRY
### OTHER NATURAL COMPOUNDS/PESTICIDES

- Honeybee intake of the natural compound quercetin leads to a reduction in the concentration of the pesticides imidacloprid and tau-fluvalinate but not of tebuconazole
- Uptake of the fungicide azoxystrobin in plants leads to formation of hitherto not reported phase 2 metabolites
- Common spraying patterns with synthetic pyrethroids in private homes with the purpose of combatting bedbugs leads to accumulation of the compounds in the home environment

- **FUTURE RESEARCH**
- Identify metabolites of pesticides in groundwater through the use of data dependent acquisition in linear ion trap mass spectrometry



## NATURAL PRODUCT CHEMISTRY AND ENVIRONMENTAL CHEMISTRY
### CEREAL BENZOXAZINOIDS (BX) IN RELATION TO HEALTH

- BXc with reported pharmacological effects found in whole grain bread year 2009
- Hydrothermal processing before baking: Substantial changes
- High BX content found in commercially available bread
- BXs are taken up and metabolized in humans, rats and pigs
- BXs inhibit growth of prostate cancer cells in vitro
- BXs found in prostate tissue after 1 week rye diet

- **FUTURE RESEARCH**
- Find correlation between prostate-specific antigen in 100 patients with their BX content in plasma
- Understand mechanisms of action of BX anticancer effect
- Exploit the importance of BX resemblance with melatonin

# MAJOR RECENT EXTERNAL GRANTS WITH PROJECT OR WORK PACKAGE LEADERSHIP

**RyeproC. Whole grain rye as a functional food for suppression of prostate cancer – elucidating the role of benzoxazinoids and other bioactive constituents.** -The Danish Council for Independent Research

**Exploiting newly discovered multiple-effect bioactive compounds for the development of immunoregulatory and appetite-controlling BREAD AND BREAKFAST products** - Danish Strategic Research Council

**BENZEX. Biosynthesis, transport and exudation of 1,4-benzoxazin-3-ones as determinants of plant biotic action -** ERA-CAPS

**Bioactive secondary metabolites in wheat – a hitherto underexploited resistance mechanism against Fusarium Head Blight infection and the biosynthesis of mycotoxins -** The Danish Council for Independent Research

**Ant Manure: Adding value to "ant manure" – from chemical interactions to ecosystem effects** - The Danish Council for Independent Research

**Arming honeybees with nature's pharmacy** - The Danish Council for Independent Research

**Pyrethroids in private homes -** Danish Environmental Protection Agency.

**Pesticides in Cocoa-growing soils in Ghana** - BSUEC



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