

Organic Heterogeneous Material



“Monimuotoviljat webinaari -
Heterogenous seed materials webinar”
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BOOST (Organic RDD-6)
and DIVERSILIENCE (CoreOrganic)

Why organic plant breeding?

- All plant breeding is about adapting germplasm to local conditions
 - climatic conditions
 - consumer demands
 - agronomic practise
 -
- All local conditions should in principle have their own breeding program, including organic farming
 - all experiences shows that the best varieties under conventional conditions are not the best under organic conditions

What is organic plant breeding?

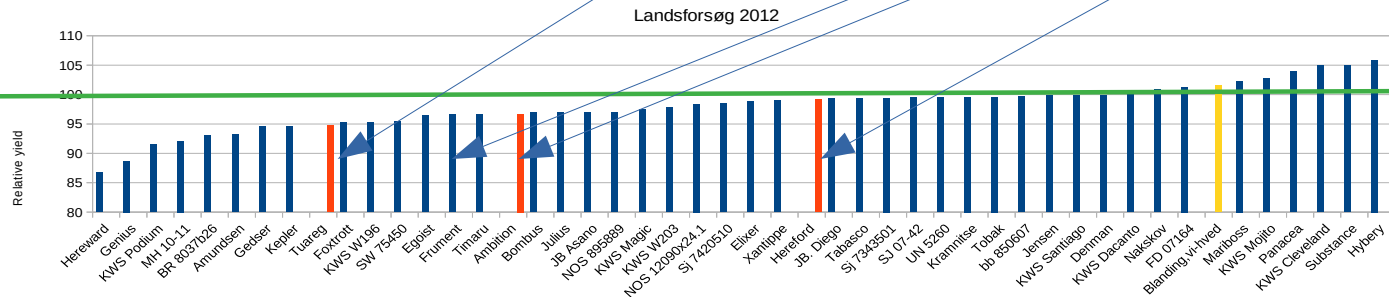
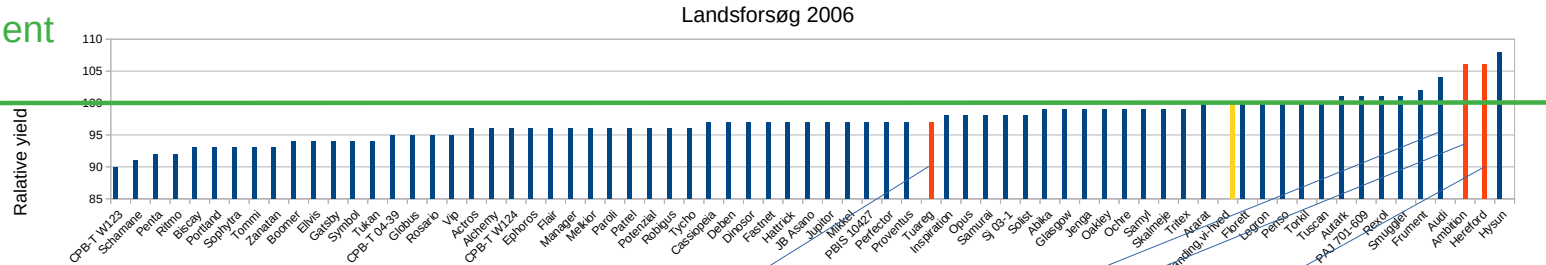
- Selecting the best from conventional plant breeding
- Conventional breeding or organic farming
- Organic plant breeding

Organic plant breeding

- Trait based breeding targeted selected problems in organic farming (eg. weed competition)
- Breeding for sustainability (system based breeding)
 - genetic diversity
 - diversity between fields
 - diversity within fields (organic heterogeneous material)
 - polygenetic resistance
 - breeding for interactions
 - mixed cropping
 - interactions with microorganisms
 - Involvement and fairness
 - organic integrity

Yield of Danish wheat varieties

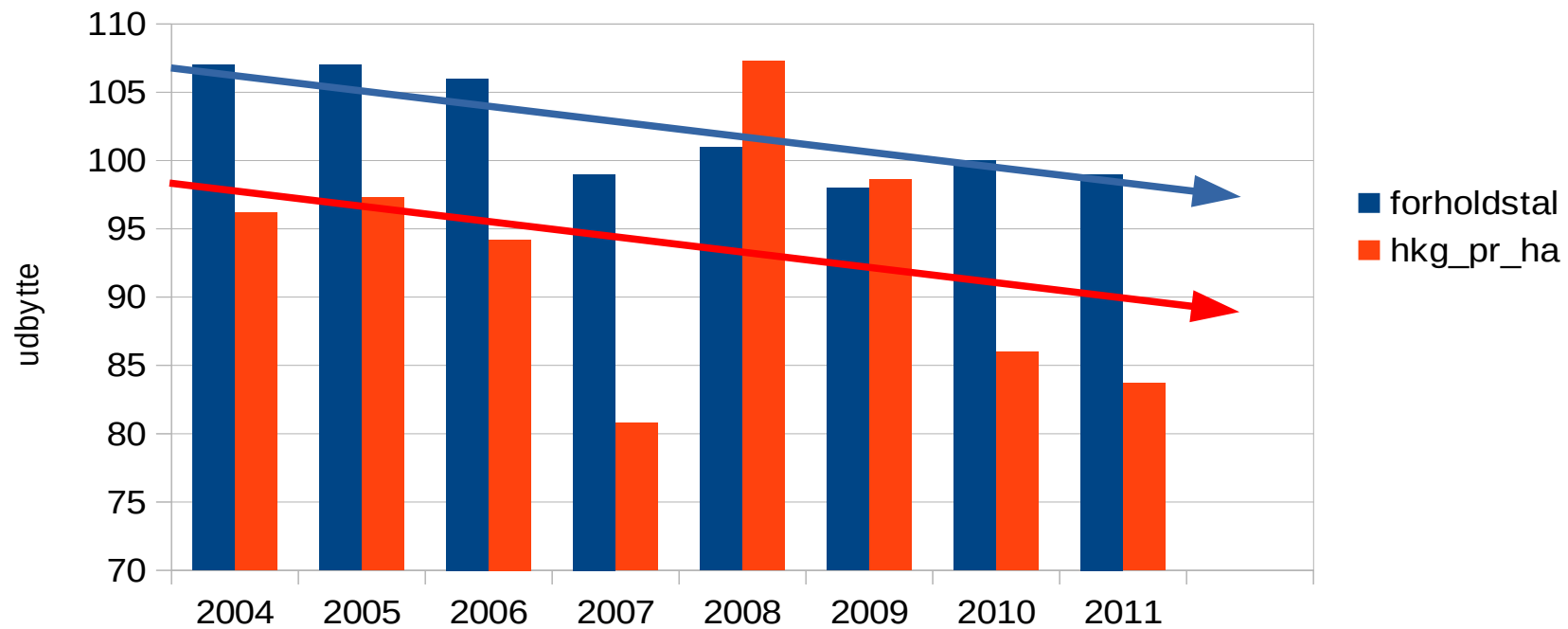
VCU
requirement
for new
varieties



Conclusion: Huge differences in yield in the Danish variety list of winter wheat
Yield seems to decrease over time

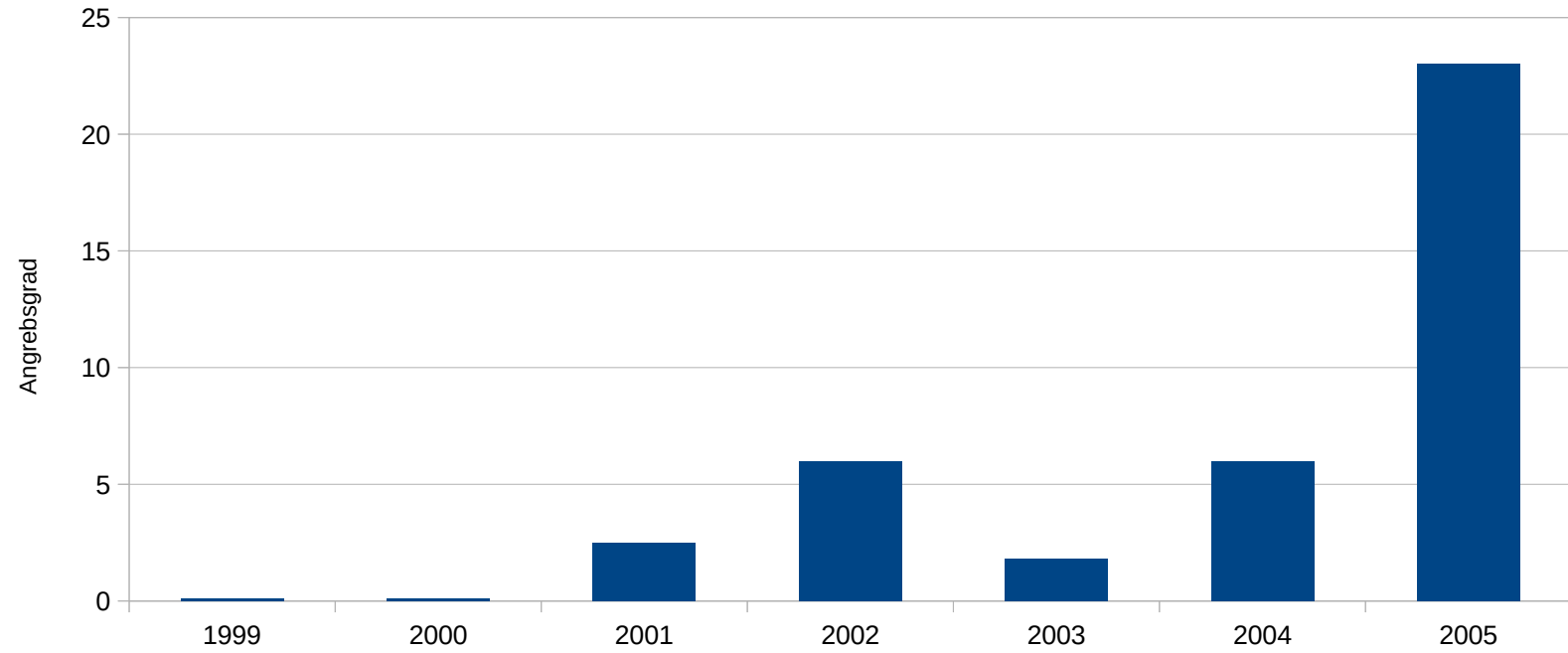
Ambition, vinterhvede

Landsforsøgene



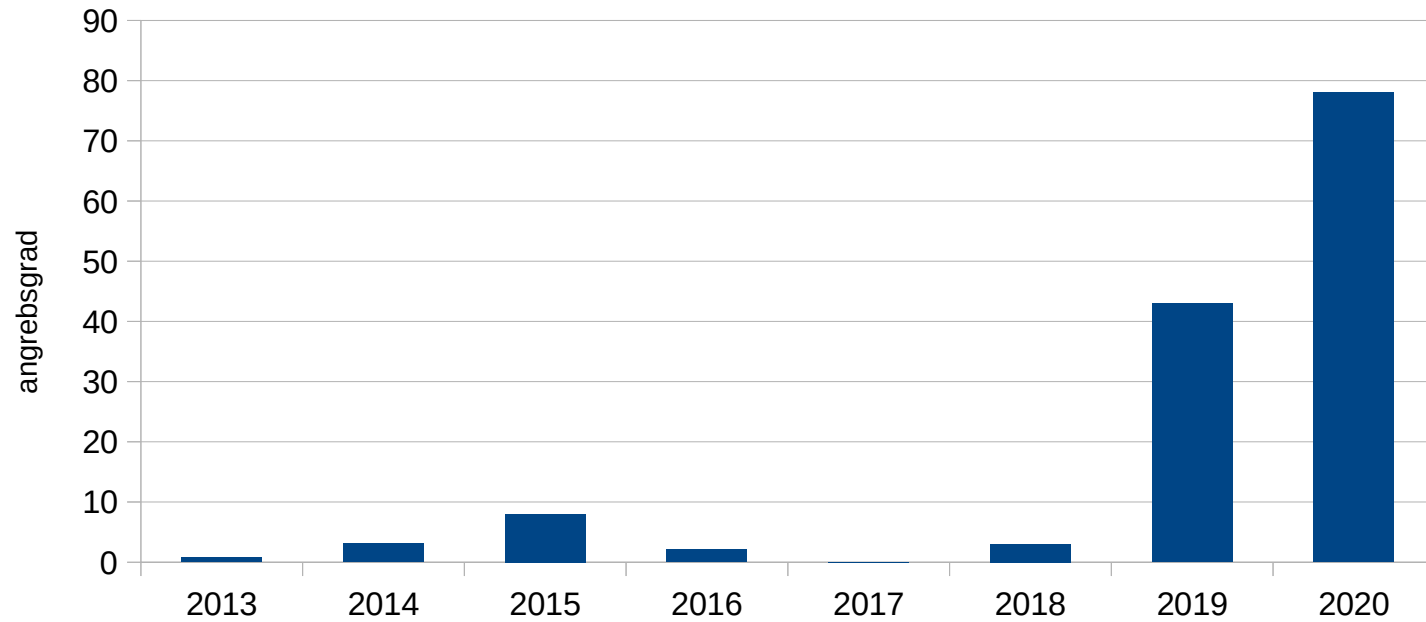
Gulrust i Cardos

Landsforsøgene



Gulrust i Benchmark

Landsforsøgene



Plant pathology lesson 1A



Monogenic
resistance is a
lock that can
be unlocked

Plant pathology lesson 1A

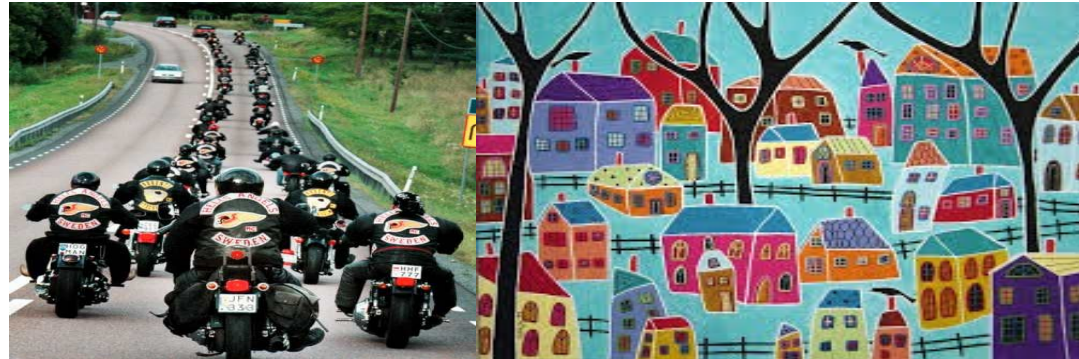


Monogenic resistance is a lock that can be unlocked

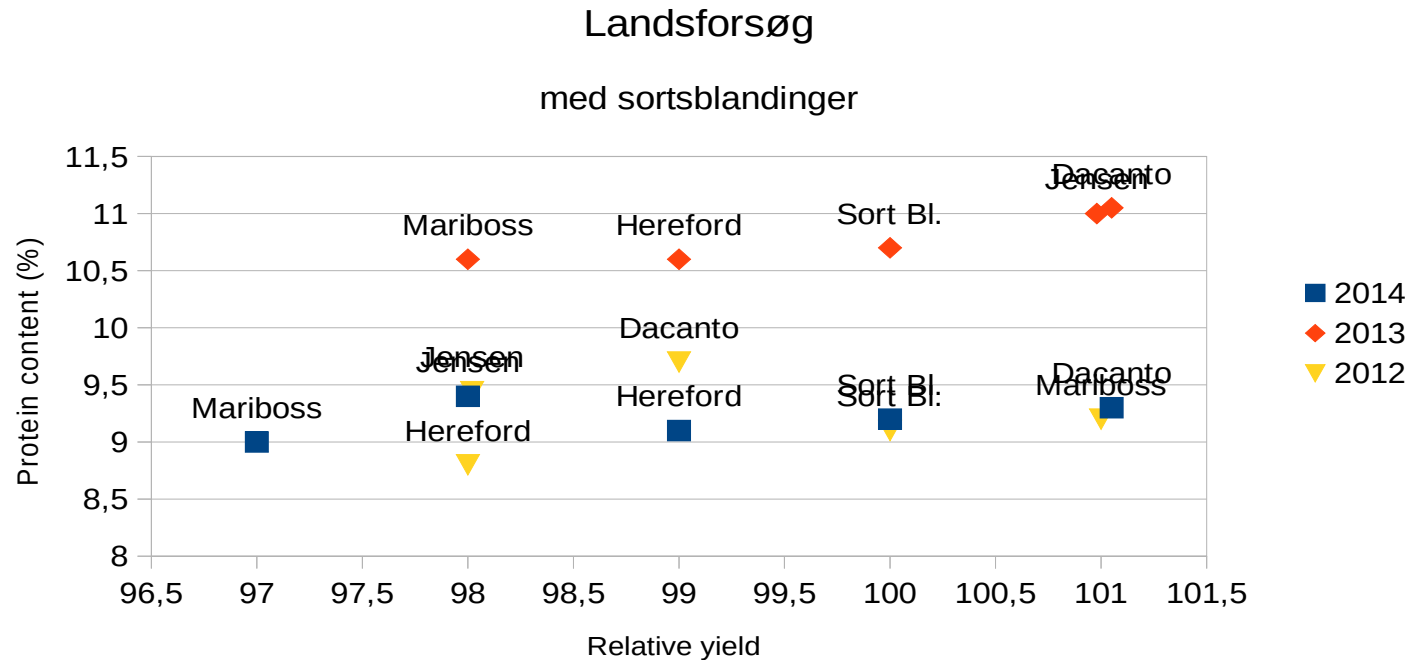
If all computers in a company uses the same password, you will end up in trouble. It is elementary dear Watson!



Virulent pathogens multiply if there is a selection pressure



Varieties and variety mixtures



Conclusion: You never know which variety will be the best, but the variety mixture is always second best, and better than the mean of the pure lines

Why do we not have organic plant breeding?

- Flat rate administration cost is favouring large scale markets. Volume based costs favours market diversity.
- Post payment systems (royalty based) is favouring large scale markets. The bigger, the more profitable.
 - No variety protection on OHM and conservation varieties
- Pre-payment (project based) can be targeted desired specific problems, such as organic farming.

Conclusion on funding

- Public or food chain funding is needed to start up organic plant breeding
- In the present situation, an alternative seed system is therefore needed for promoting organic plant breeding

Is alternative seed systems legal in EU?

- EU seed legislation
 - All seed shall be certified (almost all)
- Plant treaty (ITPGRFA)
 - It is mandatory for national authorities to give room for *in situ* conservation
- UNDROP (Human rights over-rules other legislations)
 - Farmers have the right to sell their own seed and maintain their seed systems

Conclusion: Alternative seed systems are not only legal, but actually mandatory in all countries

Loopholes and new opportunities

- Cheap registration for heritage varieties
- New organic regulation opens for Organic Heterogeneous Material
 - cheap in fees
 - cheap in production (purifying)
- Exemptions for non commercial use, incl. trials and research
 - also farmers and millers can do trials (and they can do very big trials)

Conclusion: It will violate the ITPGRFA treaty,
if membership countries do not utilise some of these the loopholes

Landsorten

- Membership organisation established 2021
- Promoting heritage and organic bred varieties and OHM
- Annual fee (most of which is to be returned to the breeders):
 - ~30€ for private non producers
 - ~120€ for producers
 - ~30€ per hectare + ~25€ per ton flour
- 125 members
 - incl. ~70 producers
 - 90% from Denmark

The Landsorten set up

- As far as possible based on home saved seed.
- Logistic support for home saving of seed.
- No central seed production. All seed is produced by members and sold directly farm to farm.
- Landsorten plans the production
- Bread wheat, malt grain and feed
 - Certified Organic Heterogeneous Material or heritage varieties certified by Landsorten
- Minor crops and varieties are sold as seed for trial production
 - durum wheat, spelt, purple wheat.....

The BOOST project

- Landsorten
 - development of the seed system
- Agrologica
 - breeding varieties and seed research
- Gammel Buurholt Hovedgård
 - Quality seed sorting
- Copenhagen University
 - Seed analysis
- KOST
 - Market development



Buurholt
Mobile seed cleaning and
milling



Farmers
Bakers
Millers
Landsorten



KOST
Culinary
development and
marketing



University of Copenhagen
quality analysis and research



Agrologica
Breeding and research



Mobile seed cleaning



Mobile stone mill



TriQ protein improvement

BoMill Technology

VIDEOER

developing
this

BoMill

TriQ



Upgrading
populations from feed
to baking quality



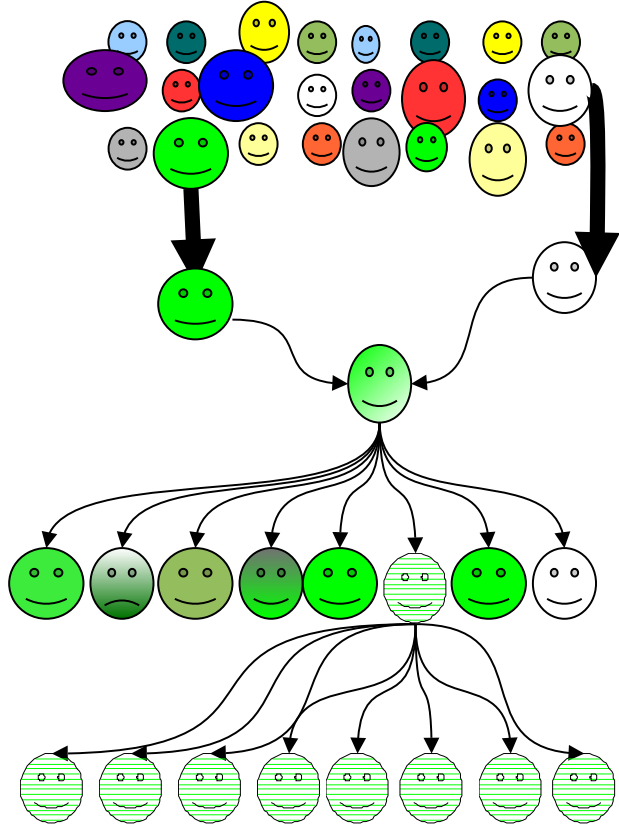
Breeding programs

- Oat
 - increased oil content
 - Naked oat (spring + winter)
- Spring rye
 - improved straw strength
- Barley
 - Improved baking quality in naked barley
 - different colours in naked barley
 - GN-free malting barley
 - resistance against CCN
- White lupin
 - earliness
 - oil content, anthracnose resistance
 - culinary quality
- Lentils
 - growth habit
 - culinary quality
- Millet
 - Foxtail, Barnyard and Proso millet
 - Earliness
- Wheat
 - Resistance to common bunt and CCN
 - Purple, blue, black, yellow and white
 - Dietary fibres, ATI and Fructans and allergies
- Durum
 - Kernel hardness and endosperm colour
- Spelt
- Tritordeum
- Indian dwarf wheat
- Xinchang rice
-

Priority traits

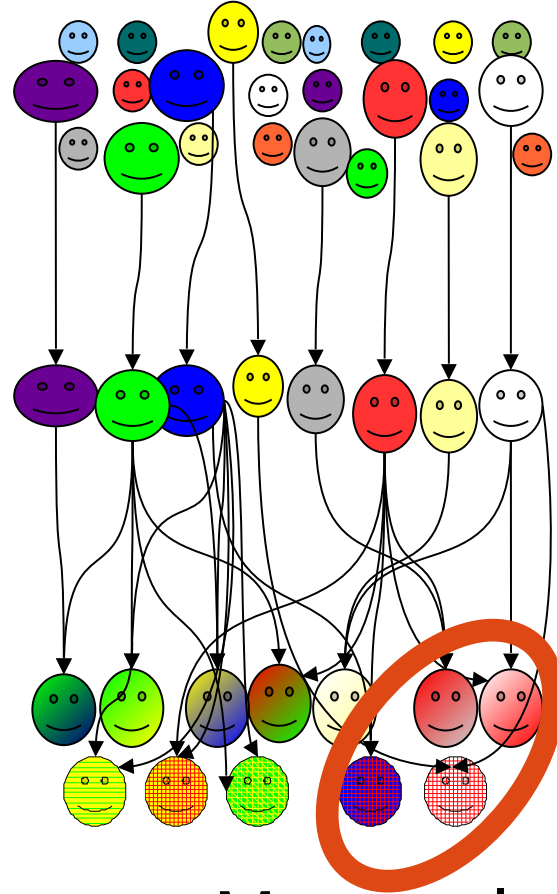
- Protein content in bread wheat
- Weed competition (barley and wheat)
- Diseases (rust, mildew, common bunt, CCN...)
- Quality traits (purple wheat / taste / seed hardness / gluten allergy /)
-

Pure line breeding



Multiplying single plants

Population breeding



Mass selection

CCP-YQ DK-2012

White
seed

Hard seed

Soft



Image sorting of white seed landrace



Hard white seed



**Soft
white seed**

Image sorting of a CCP

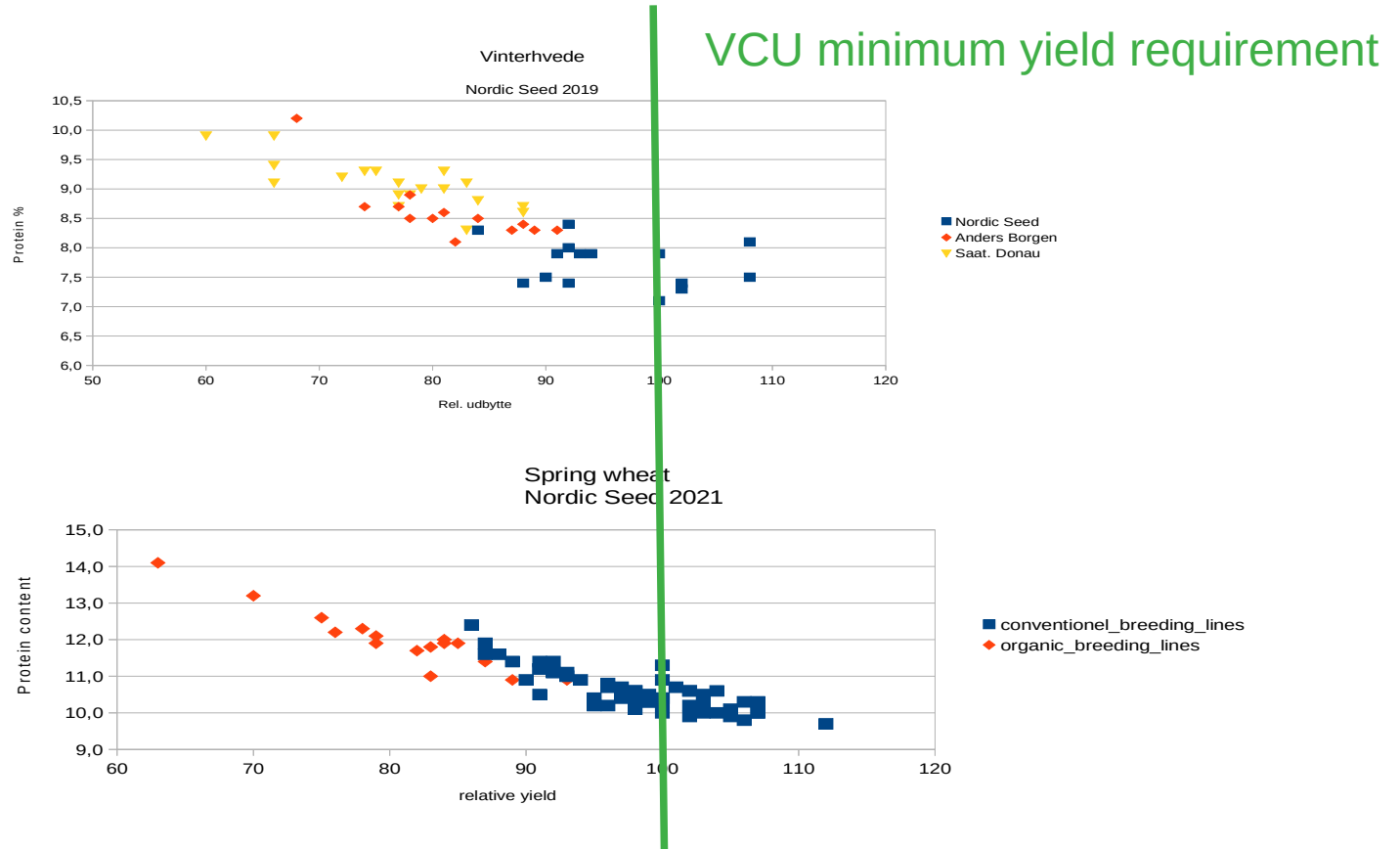
The image shows two piles of wheat seeds on a dark wooden surface. The seeds are light brown and oval-shaped. The pile on the left is labeled 'Hard seed High protein' and the pile on the right is labeled 'Soft seed low protein'. The seeds are scattered on a wooden surface, with some still inside white paper bags. The background is a dark blue surface.

**Hard seed
High protein**

**Soft seed
low protein**

Protein content in organic wheat

ØKOSORT-II
project

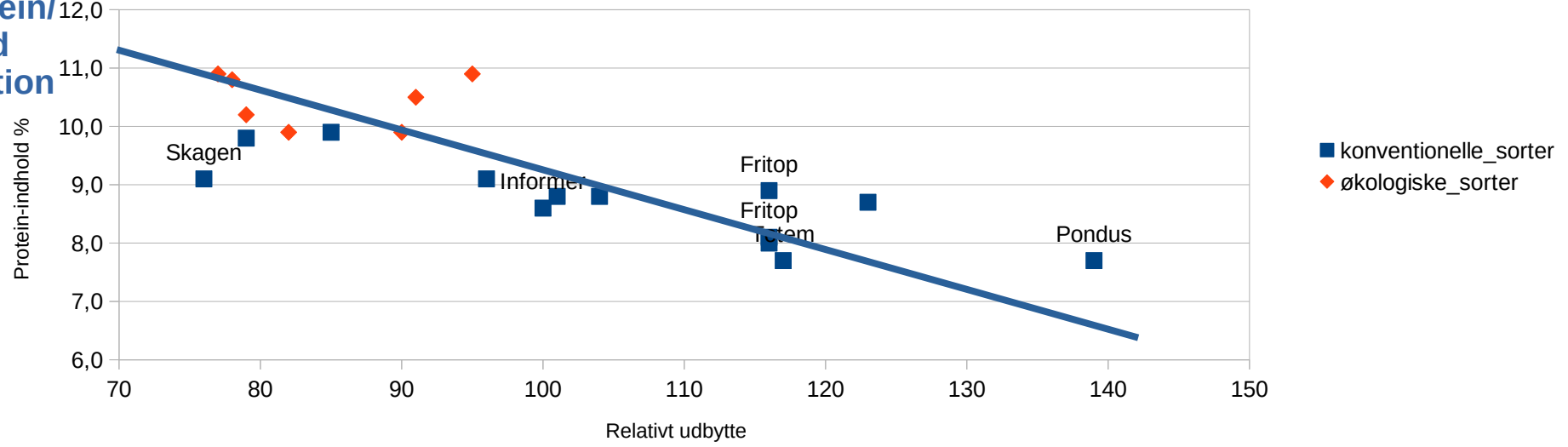


Protein content in organic wheat

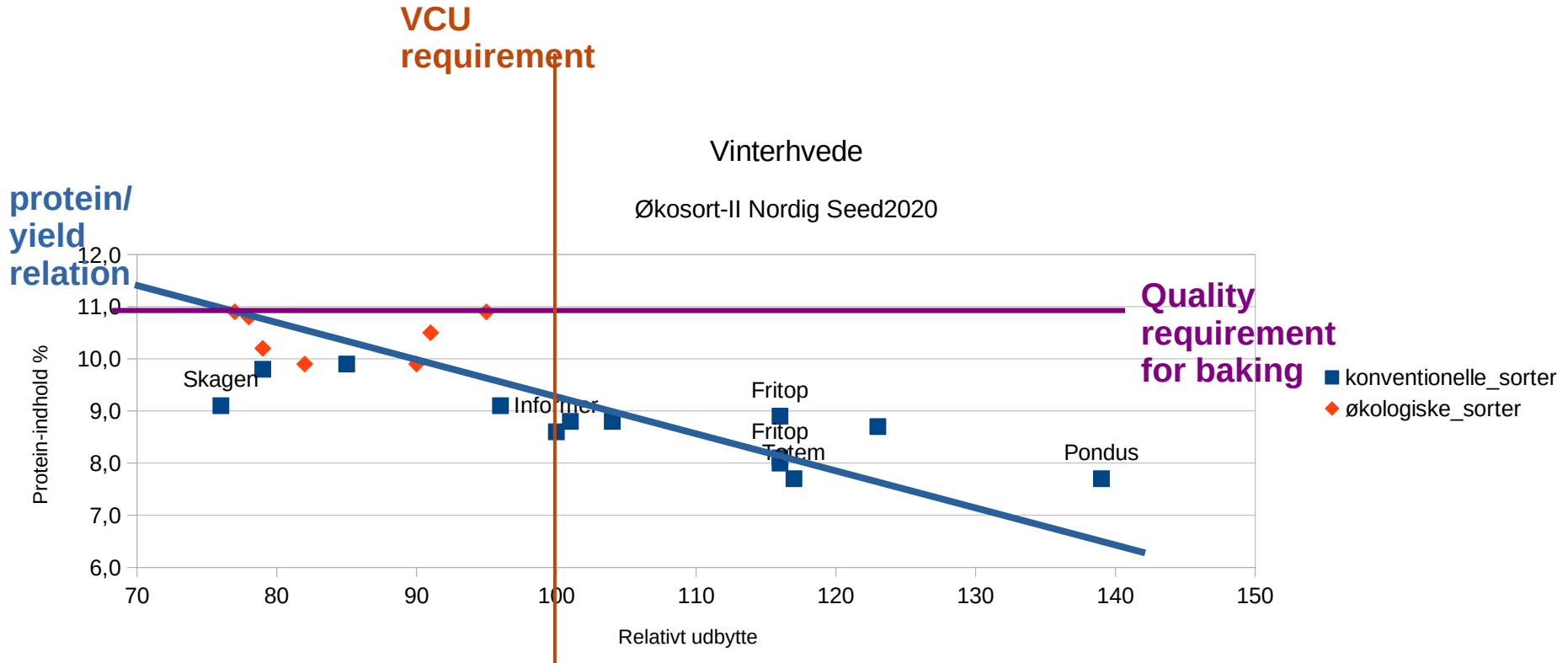
Vinterhvede

Økosort-II Nordig Seed2020

protein/
yield
relation



Protein-indhold i økologisk hvede



Weed competition in organic cereals




Weed competition in organic cereals



Weed competition in organic cereals



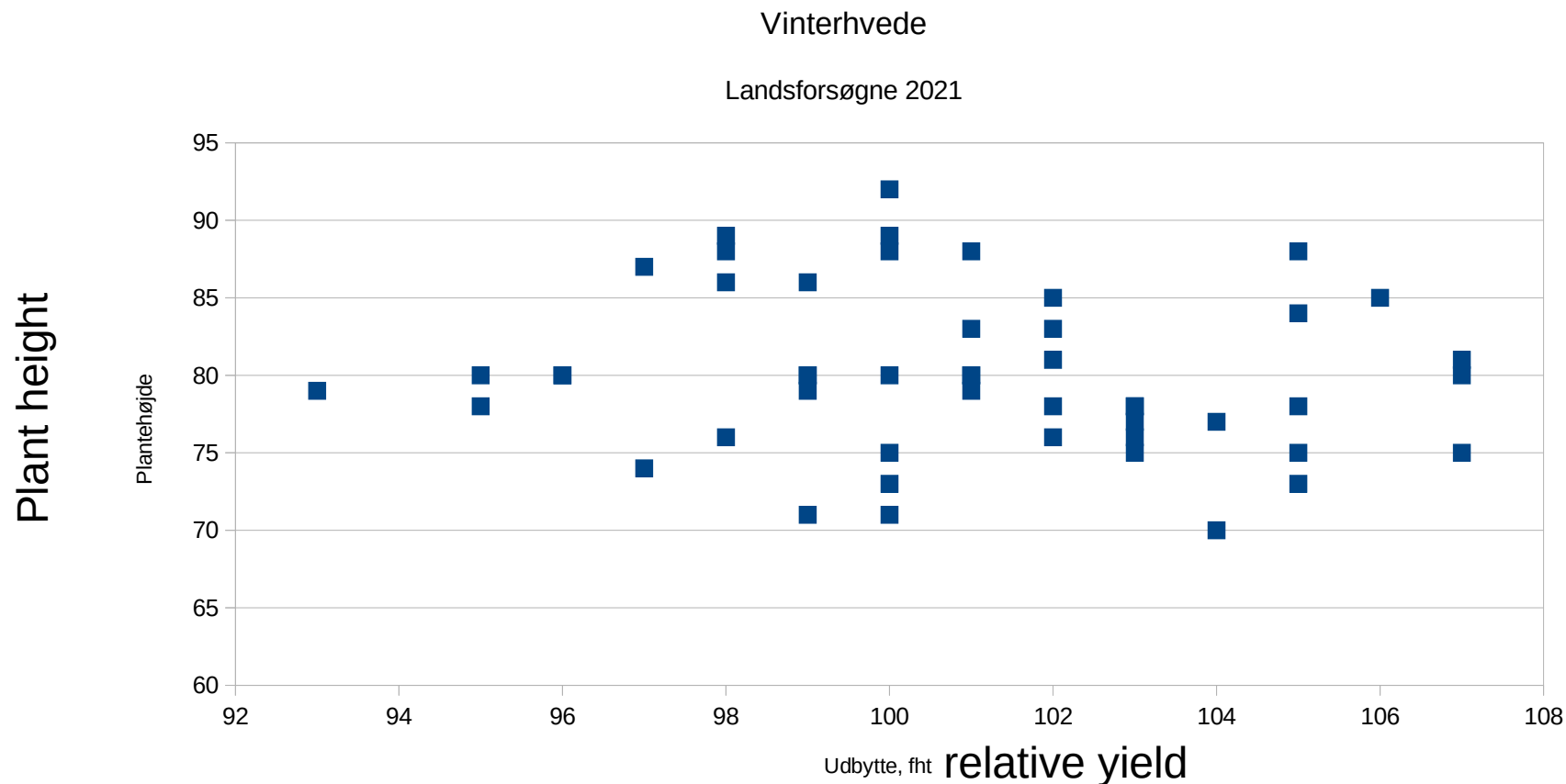


Klosner Disentis

Evergreen og Leurika

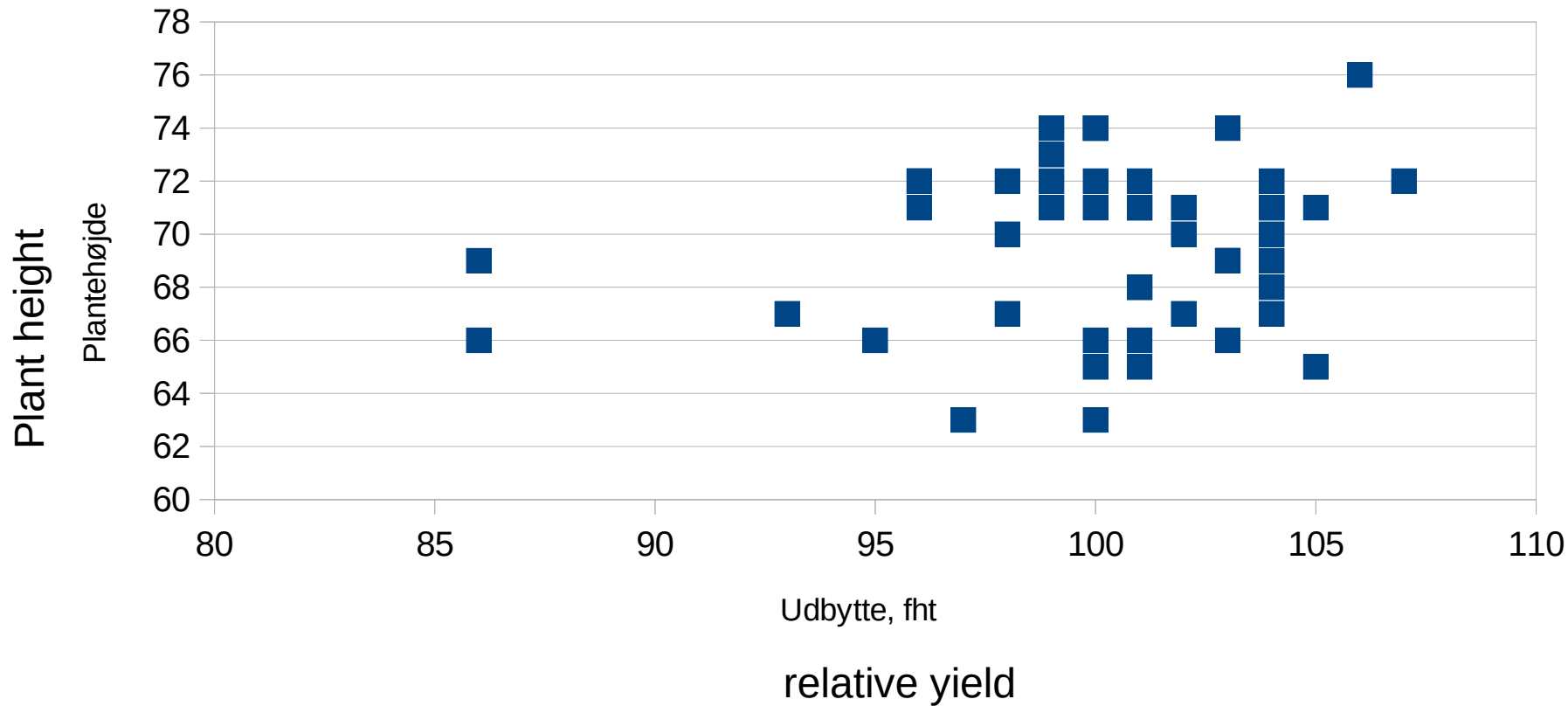
Obersaxen

Weed competition in organic cereals



Spring barley
Vårbyg

Værdiafprøvning 2021



Varieties from Landsorten

- Conservation varieties
- (Organic bred varieties)
- Organic heterogeneous material
 - multi line mixtures
 - CCPs

Examples of Landsortens organic heterogeneous material

- **Mariagertoba:** Spring wheat from 2020. a mixture of 25 breeding lines with good baking quality
- **Popkorn:** Winter wheat mixture from 2017. Mixture of 50 breeding lines with good baking quality
- **Pop Pjerrot:** White wheat from 2020. Mixture of 15 breeding lines with good baking quality
- **Pop Giraf:** Winter wheat from 2020. Mixture of 15 breeding lines with good baking quality and +95cm
- **Pop Gurli:** Winter wheat from 2020. Mixture of 25 breeding lines with high yield potential
- **Pop Nul ÅI:** Spring wheat with resistance to CCN

Organic Heterogeneous Material

- for the future



Join Landsorten to access the diversity!

