

Genetic, ecological and economic approaches to improve yield reliability in cereals

Thomas Döring
Crops Programme Leader, ORC

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Climate change as a major challenge for crop production

- Facing more extreme weather events – but current varieties are adapted to "moderate" conditions.
- Climate to become more variable and less predictable – but crops not adapted to *both* extremes (e.g. dry *and* wet).
- Aim: make crop yields less vulnerable to climatic fluctuations: increase reliability (yields high & stable).

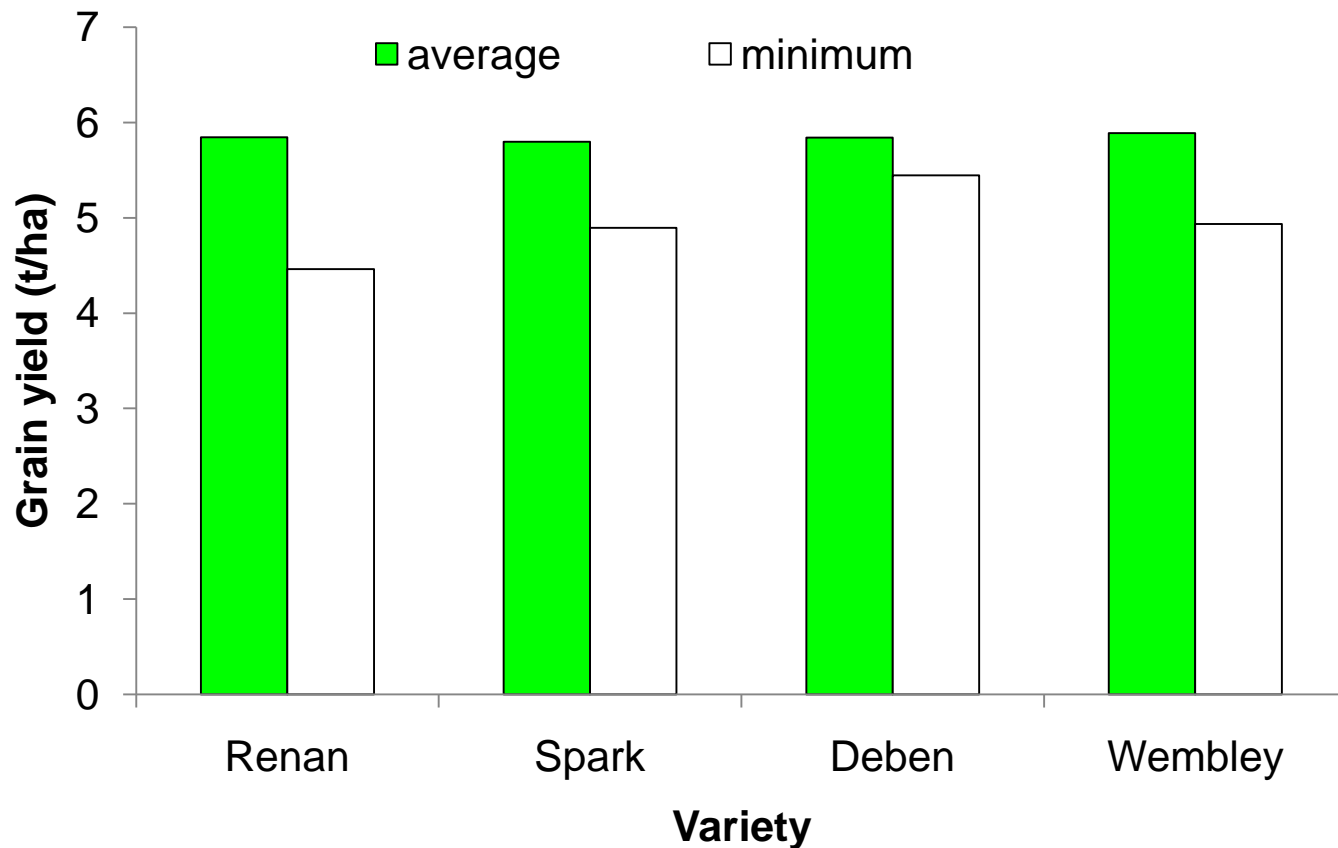
Resilience

Approaches to make yields more reliable

- Genetic: Choose reliable varieties
- Ecological: Use plant diversity to increase reliability
- Economic: Collaborate and share risks



Do varieties differ in their reliability?



Grain yields over 3 years on Sheepdrove Organic Farm

Yes they do, but data on reliability not easy to access

Why use diversity?

Compensation: if some fail, others take their place.

Complementation: different individuals use complementary niches



Ecological approaches: diversification

Using plant diversity to increase reliability



Monoculture:
Rice as an
example



Getting more
diversity with a
mixture



Huge diversity
in a population

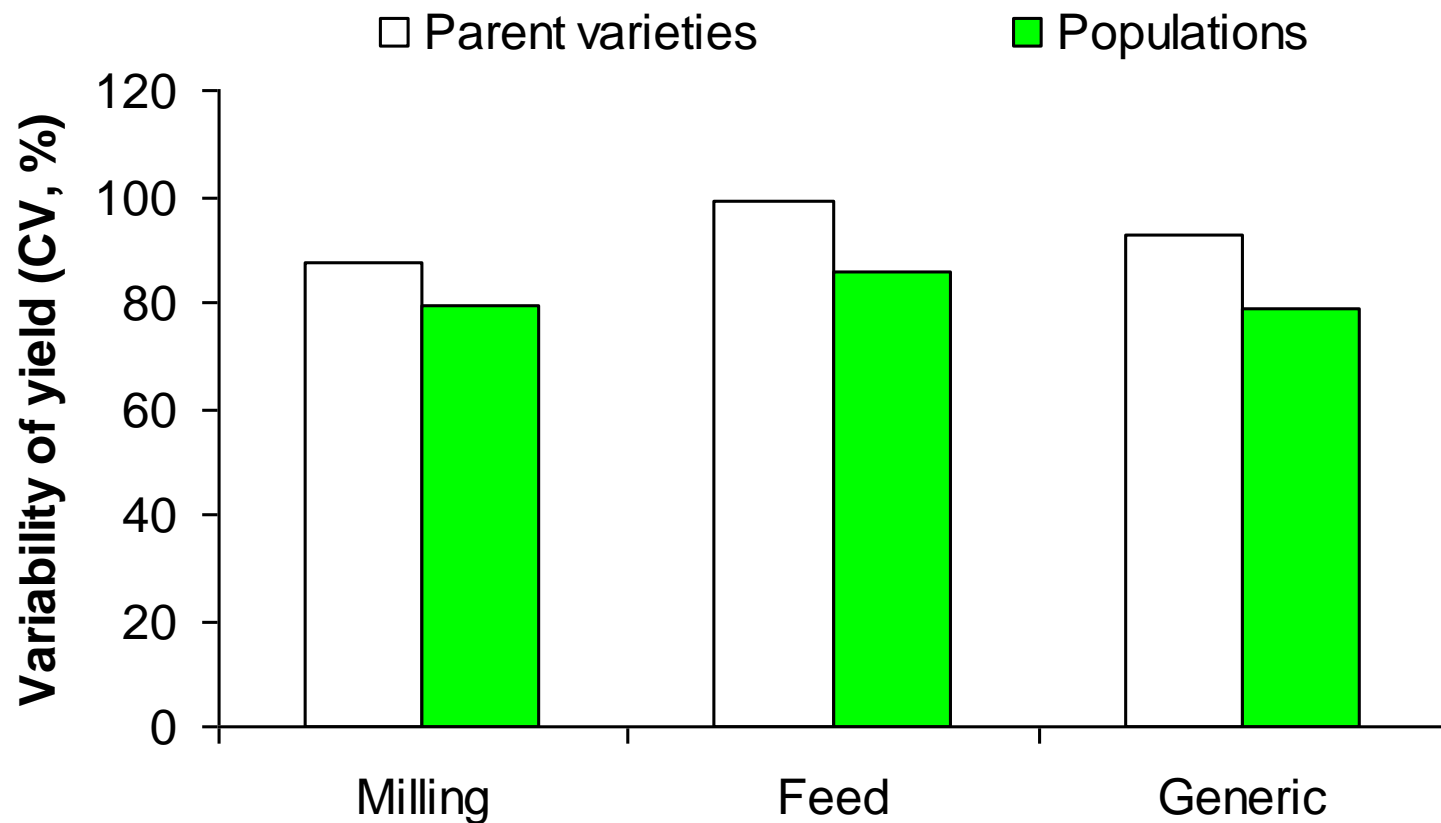
Ecological approaches: diversification

Composite Cross Populations in wheat

1. Multiple crosses between 20 parent varieties
2. Offspring from **all** crosses is sown.
3. Bulking up seed over the years by sowing and re-sowing.
4. Resulting seed is genetically very diverse.

Ecological approaches: diversification

Yield stability of wheat populations



Population: lowest yield variability compared to their parents (across 3 years, 4 sites)

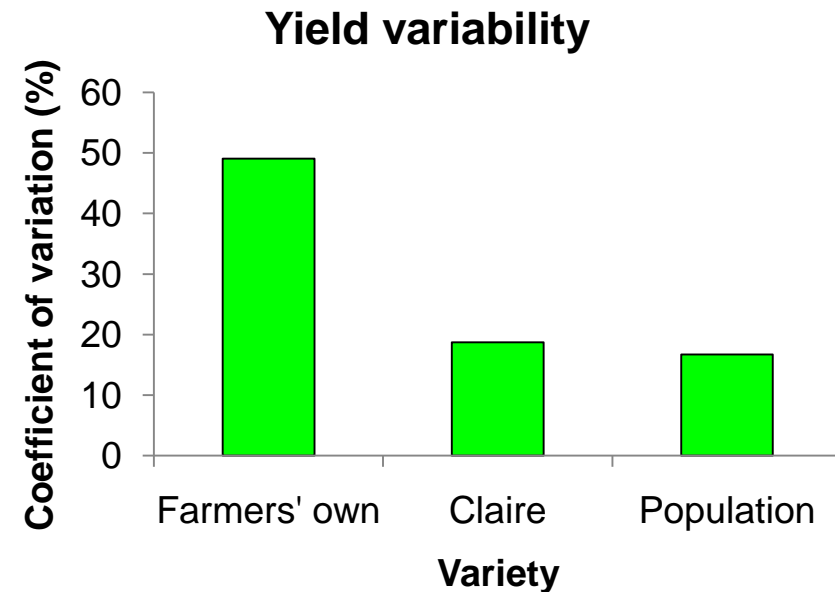
Ecological approaches: diversification

Yield stability of wheat populations

Map of participating farms in Wheat Breeding LINK project



Yield variability over 2 growing seasons lower in wheat populations than in control variety Claire and farmers' own variety



Diversity on various levels

- Genetic diversity
 - ◆ Populations (wheat, barley and oats)
 - ◆ Variety mixtures
- Species diversity
 - ◆ mixtures of legume species
 - ◆ agroforestry systems

**Improving
resilience**



Economic approaches: share risks

Co-operation between farms could help to share risks of variable yields



Yield reliability: summary

Diversify & collaborate!

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Thank you very much for your attention!

Stability and reliability: interactive

What is your preference?

(1)	variety A	variety B
year 1	4.9	4.5
year 2	5.1	5.0
year 3	4.9	4.0
year 4	5.1	7.5
average	5.0	5.25

(2)	variety A	variety B
year 1	4.9	4.5
year 2	5.1	4.6
year 3	4.9	4.4
year 4	5.1	8.5
average	5.0	5.5