



Breeding for Mixed Cropping and Anthracnose Resistance of Lupins

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DIVERSIFOOD
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I. Background: Organic grain legumes in Switzerland

- Mixed cropping 2010-2015: 290 → 1730t.
- Main mixtures: Protein pea 80% / barley 40%;
Faba bean 80% / oats 40%
- Diversification, protein → lupins



Blue lupin	<ul style="list-style-type: none"> ✓ Anthracnose tolerance 	<ul style="list-style-type: none"> ↓ Weed competition ↓ Lower yield potential
White lupin	<ul style="list-style-type: none"> ✓ Yield potential ✓ Protein content ✓ Low alkaloid 	<ul style="list-style-type: none"> ↓ Anthracnose ↓ Late maturation



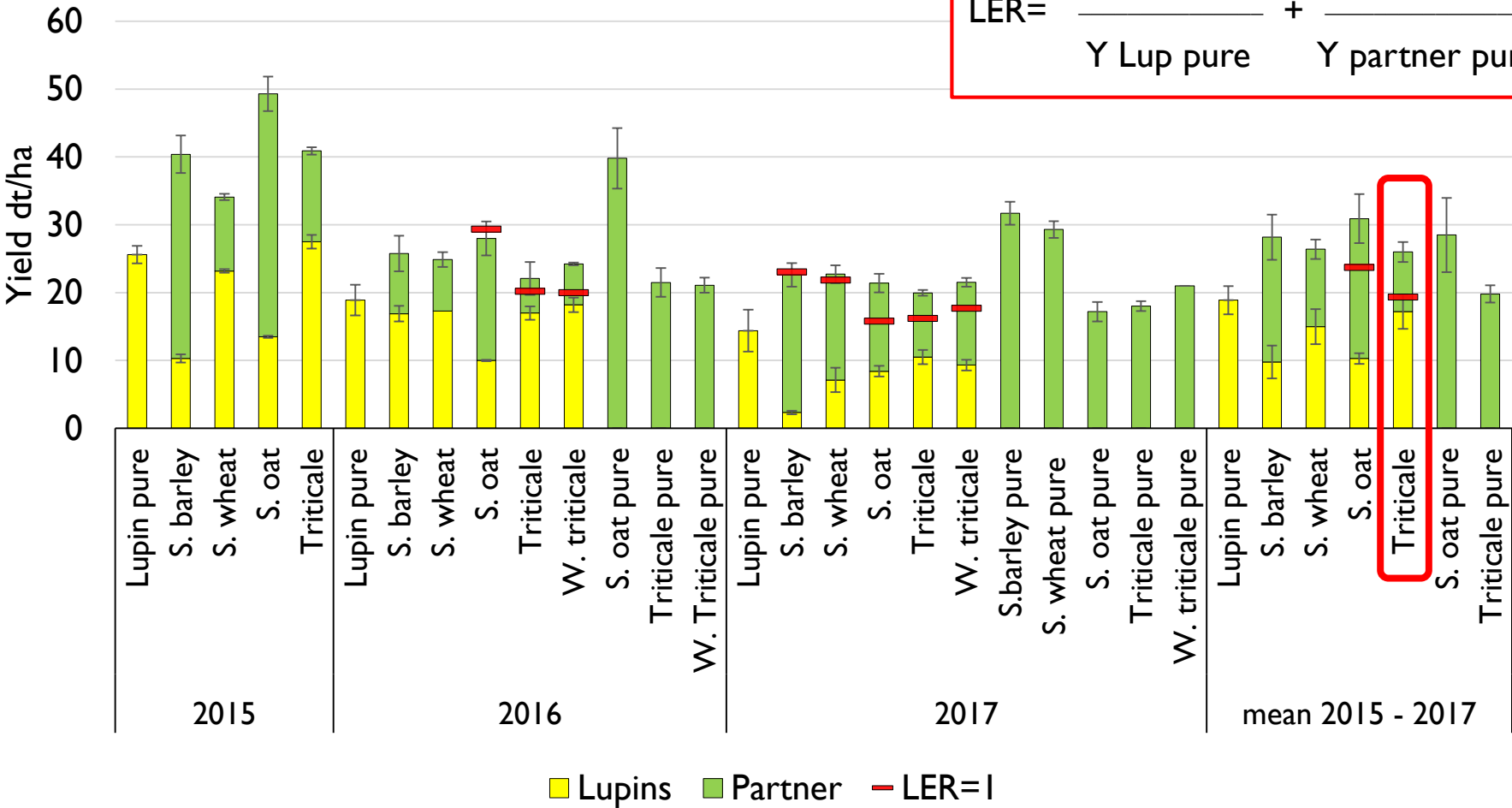
2. Objectives

1. Identify partners for mixed cropping
2. Test cultivars and breeding lines
organic
mixed cropping
3. Identify anthracnose resistant genetic resources of white lupins
4. Develop improved prebreeding material of white lupin

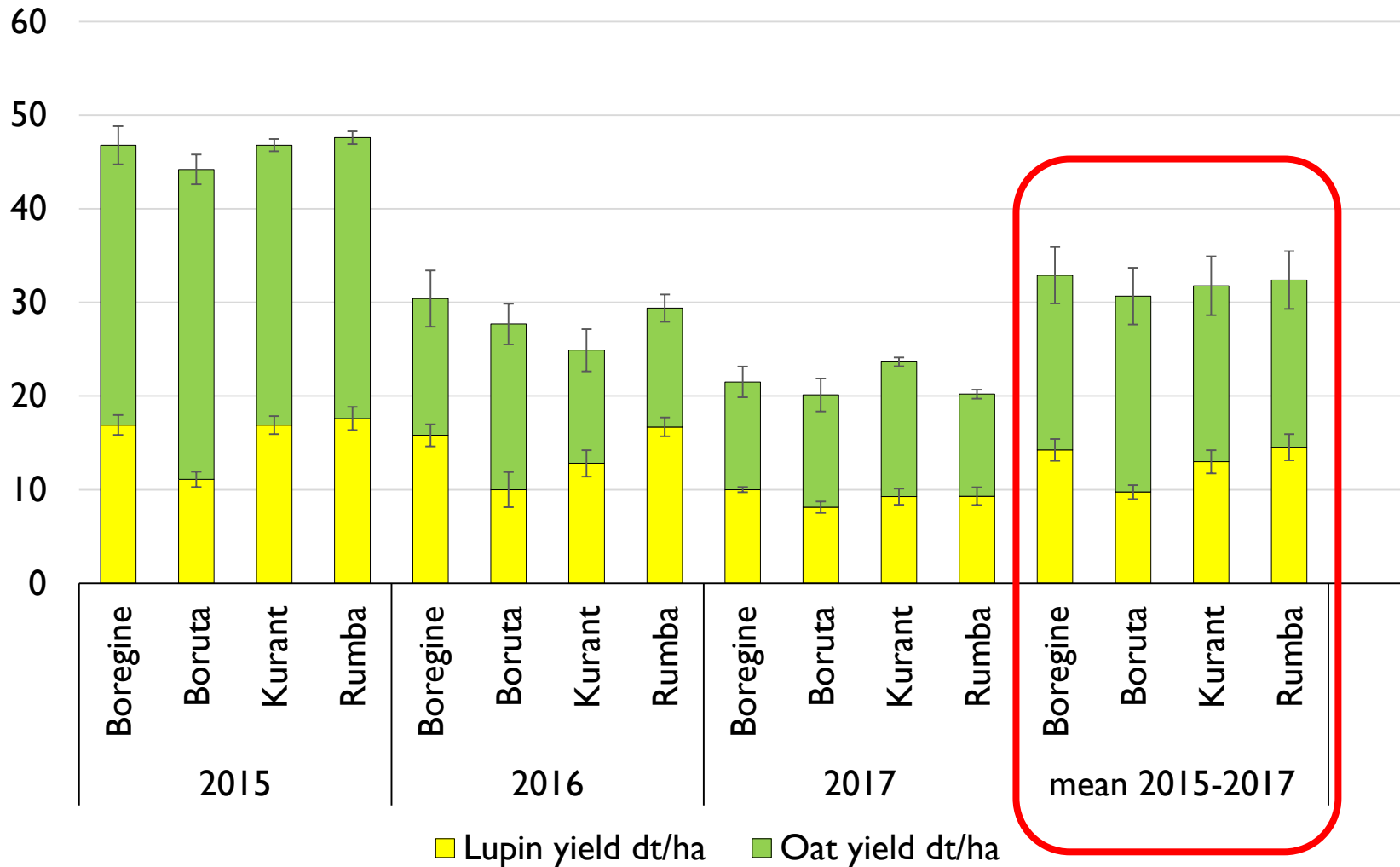


4. Results: i. Blue lupin partner trials, 2015-2017

$$\text{LER} = \frac{Y_{\text{Lup mix}}}{Y_{\text{Lup pure}}} + \frac{Y_{\text{partner mix}}}{Y_{\text{partner pure}}}$$

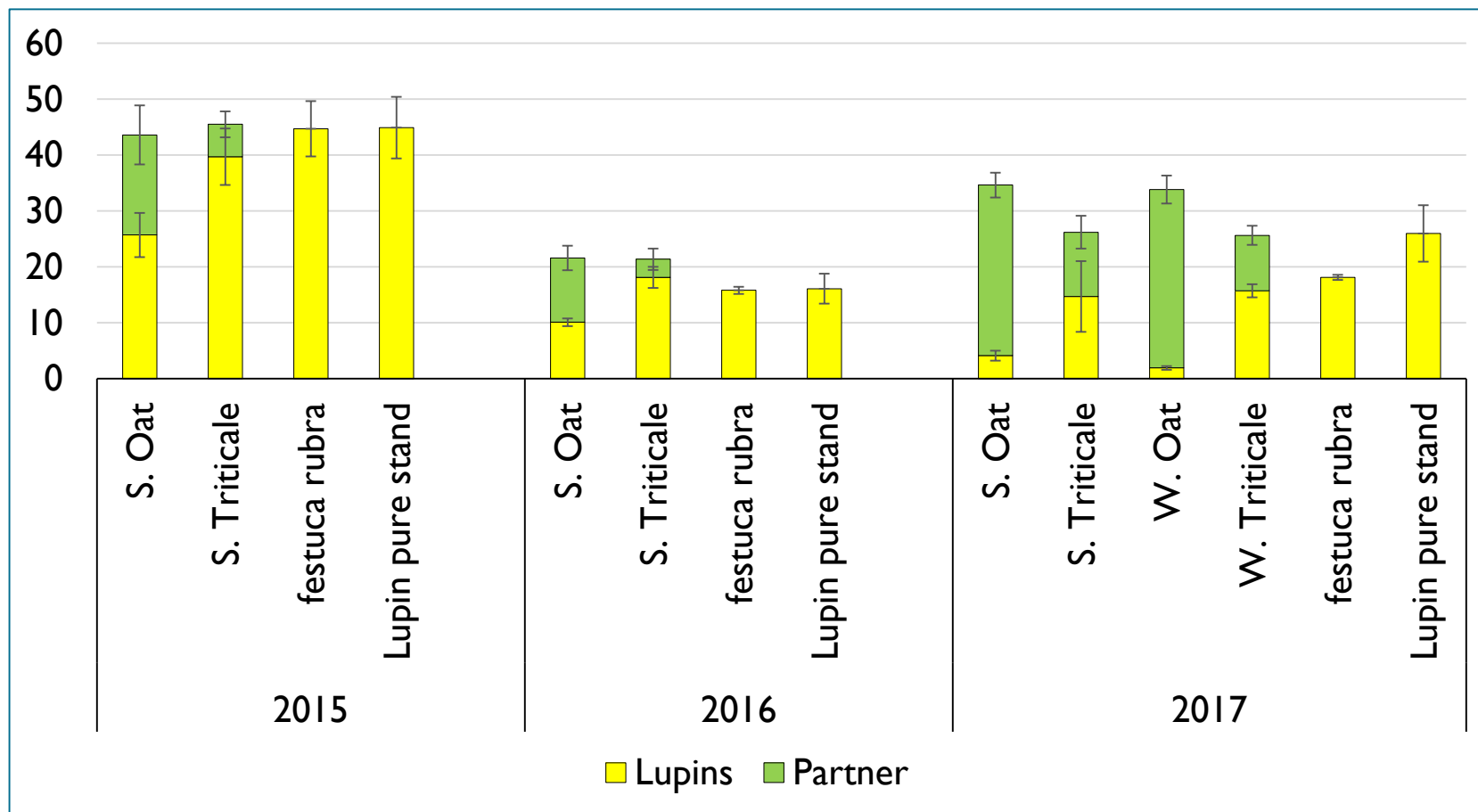


ii. Blue lupin cultivar trials 2015-2017



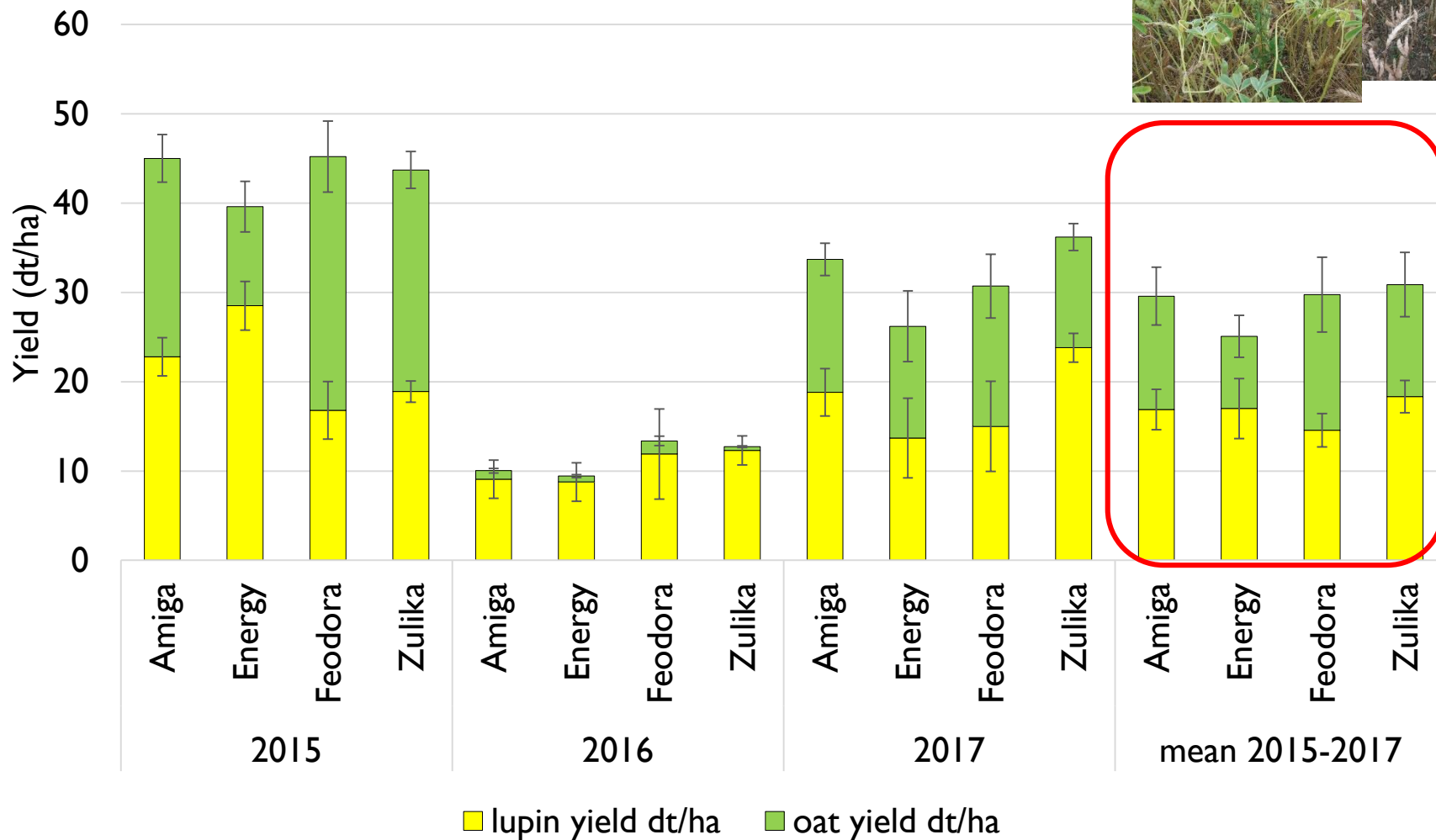
iii. White lupin partner trials 2015-2017

dt/ha



Error bars: SE

iv. White lupin cultivar trials 2015-2017



4. Anthracnose



Plantlets: symptoms



Plantlets: symptoms



Distorted growth



Brown apex and pods



Diseased pods



Diseased seeds

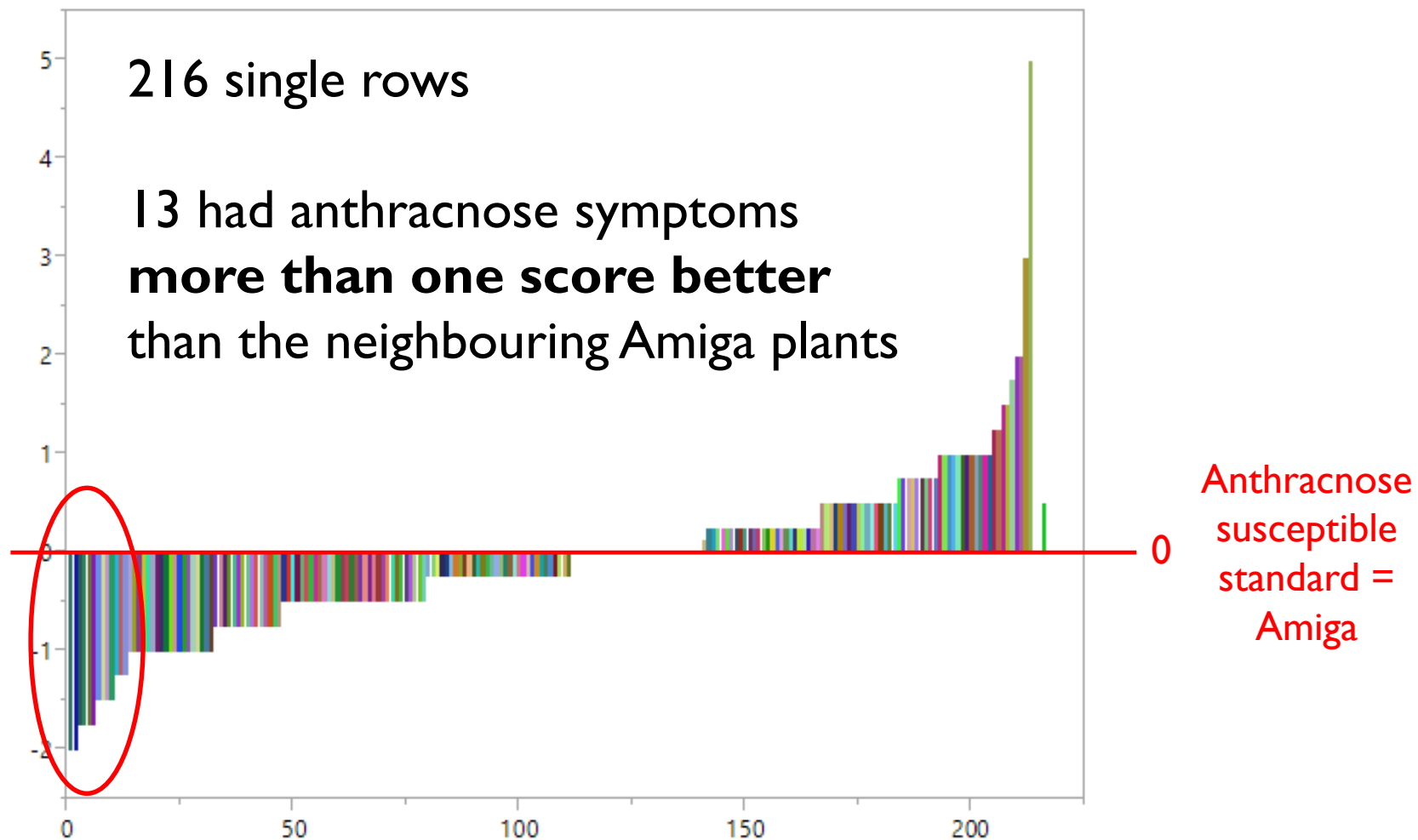
Screening of genetic resources



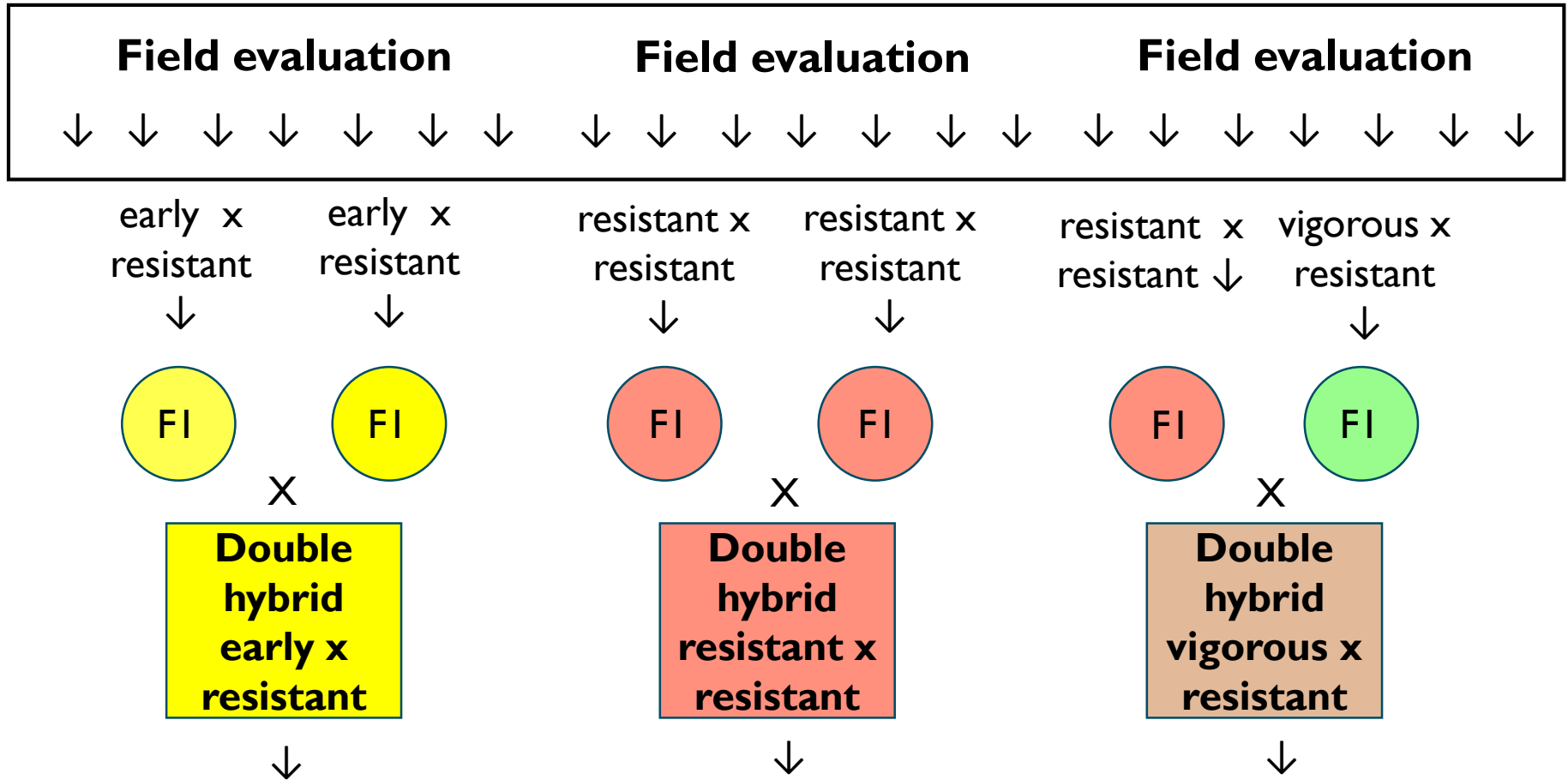
2015-2017:

single rows scored on the field between spreader rows of cv. Amiga

Genetic Resources: Variability in anthracnose susceptibility



6. Development of a composite cross population



CCP – multiply until F4

then select for resistance, early maturation, vitality, lodging resistance, low alkaloid content

7. Conclusions



First step: introduce blue lupins to farms

- recommended mixing partner: triticale
- recommended cultivars: Boruta (wet conditions); Boregine, Rumba (dry conditions)

Second step: improve white lupin system

- vary mixture relations and seed densities with winter triticale
- test new undersown partners
- improve anthracnose resistance of cultivars



Open phd position at FiBL

Title: Lifecycle and control of *Colletotrichum lupini*, the causal agent of anthracnose, in white lupin breeding

Disciplines: Plant breeding and phytopathology

Begin: April 1, 2018 (or upon agreement)

Closing date: **February 28, 2018**



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Seeds:

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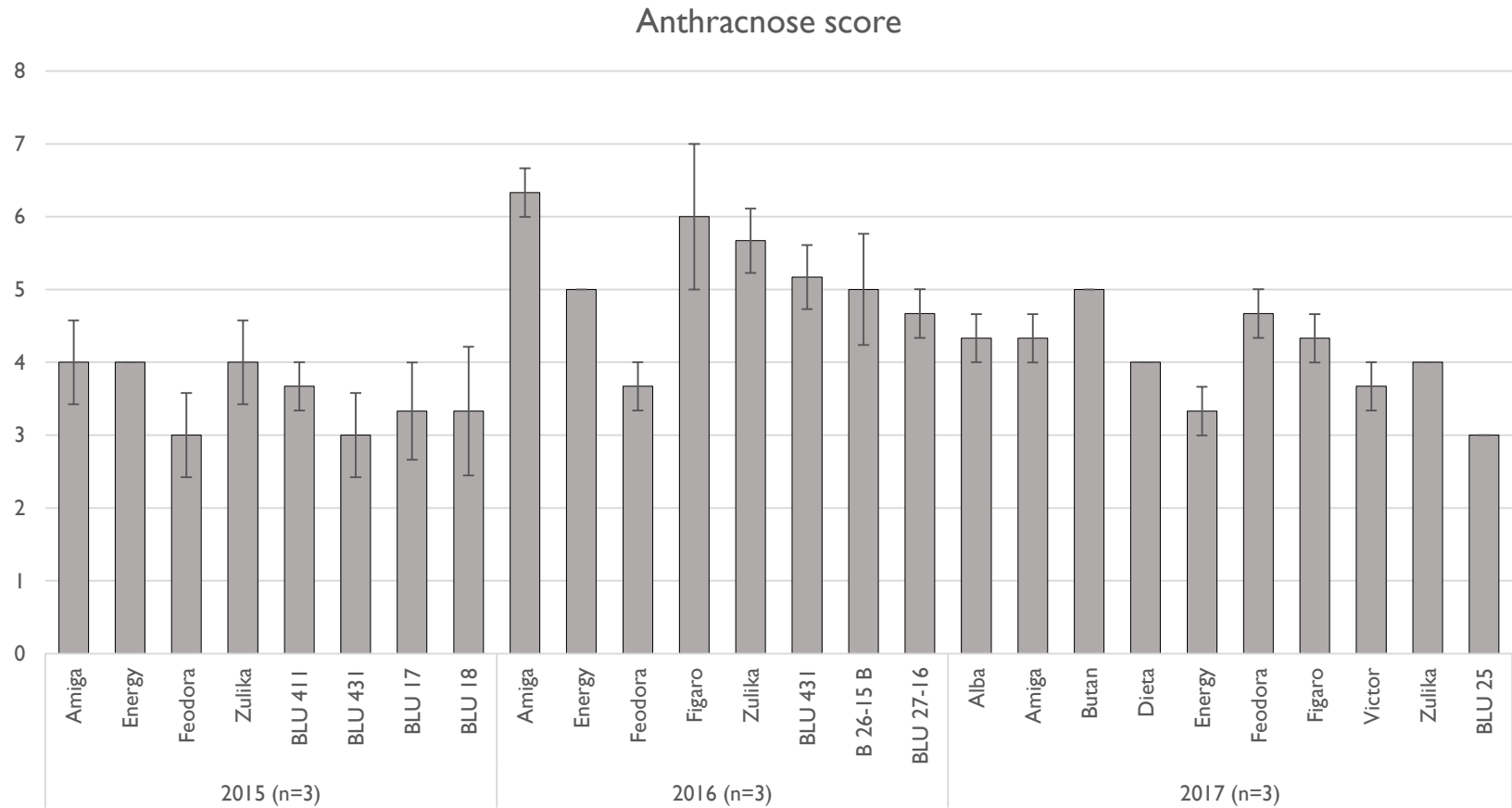
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3. Trials 2015-2017: Material and Methods

- Site: biodynamic farm bioböhler, Rümikon (High Rhine Valley, AG, CH)
- Soil/Climate: Sandy loam, low humus content, pH 6,9 / 1200mm
- Design: Randomized block, plot size 7,5 m², 3 replicates
- **Partner trials**: testing 6-7 cropping partners with
 - blue lupin cv. Boruta (Trial 1)
 - white lupin cv. Feodora (Trial 3)
- **Cultivar trials**: testing 8-12 lupin genotypes (in mixed cropping with summer oat cv. Buggy)
 - blue lupin (Trial 2)
 - white lupin (Trial 4)
- **Single rows** between spreader rows of infected cv. Amiga
 - 111 rows of genetic resources and breeder's lines harvested in 2016 from infected and selected rows
 - 101 rows of new genetic resources

iv.a. Anthracnose score in white lupin cultivar trials



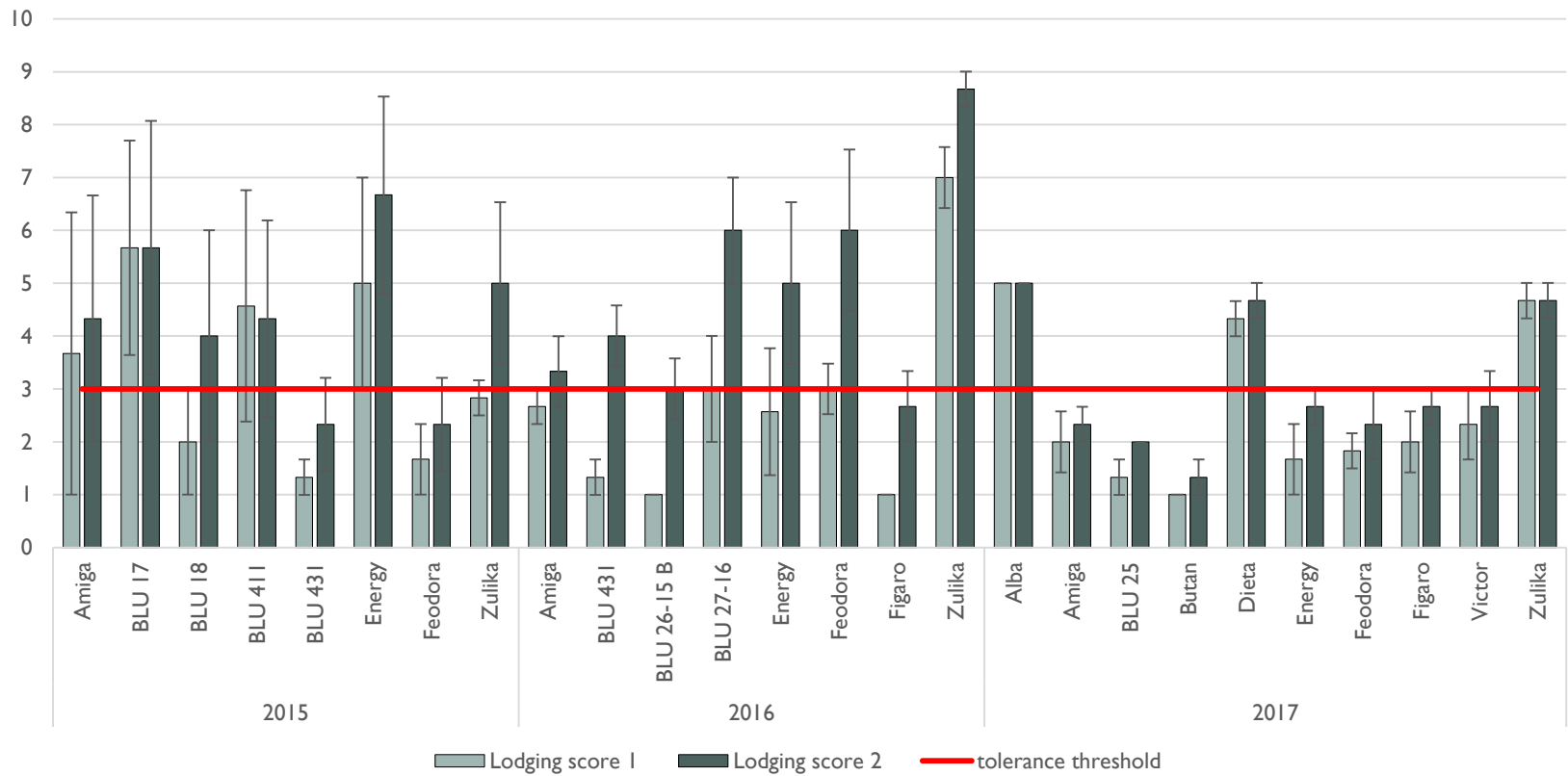
Lodging

Feodora 1.8.16

Zulika 1.8.16



Lodging in the White Lupin cultivars trials, 2015-2017



Early maturation

Feodora, 28.7.2015; Energy



iv.c Early maturation in white lupin cultivar trials

