Use of variety mixtures to reduce disease, increase resource-use efficiency resulting and enhance profitability

Workpackage 2: wheat-based rotations

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In advanced IPM treatments:

use **diverse varieties** in conjunction with other agronomic practices such as:

- Reduced fungicide dose
- Disease forecasting
- Resistance elicitors
- Reduced seed rate
- Reduced herbicide rate
- No growth regulator
- Reduced tillage
- Reduced fertiliser
Year 1

Rep 1
Rep 2
Rep 3

Advanced
Intermediate
Conventional

Pea – WW – OSR
S barley – WW – OSR
WW – WW – OSR

Single wheat variety
Three wheat varieties
Eight wheat varieties
Eight wheat varieties

Single wheat variety
Three wheat varieties
Eight wheat varieties
Increased diversity = less disease

Increased diversity = more yield

y = 7.2x + 13.6
R^2 = 0.931

y = 1.083x + 2.185
R^2 = 0.8753

y = 0.716x + 1.61
R^2 = 0.8383

% Disease reduction

% yield increase

Mixture component number

Fungicide
Control

Increased diversity = less disease

Increased diversity = more yield
Increased diversity = greater yield sensitivity (responds more to fertility)
Suitable for all tillage systems

- Zero
- Minimum tillage
- Conventional
- Compaction
- Deep plough

Disease: AUDPC

- Monoculture
- 2-component
- 3- & 4-component
Patchy arrangements in the field

Yield

Mixtures advantage:
- 2005: +13%*** ns
- 2006: +17%*** ns

Homogeneous mix

Disease

Mixtures advantage:
- 2005: -34%*** ns
- 2007: -58%*** ns
Small proportions of a resistant variety have disproportionately large effect on disease reduction (barley data)
Impact of cultivars and mixtures on a rare weed species

Average number of *Valerianella rimosa* individuals for the different combinations of barley variety cultivar (including unsown controls and mixtures as cultivars) at 120 seed m$^{-2}$. 
Conclusions

- Variety mixtures are an important agronomic method that can contribute to Integrated Pest Management
- Mixtures contribute to stability and increased resource use efficiency
- Mixtures to 76% disease reduction and 17% increase in yield (winter barley data)
- The greater the number of components the more disease is reduced
- The spatial arrangement, patch size and distribution can affect their efficacy
- Resistance components can contribute disproportionately, a 10% proportion of a resistant component accounting for up to 50% disease reduction
- Mixtures can help maintain functional diversity amongst weeds