

# WINTER WHEAT AND SUMMER SHADE

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## AGROFORESTRY IN BELGIUM

**Hypothesis** Light is a limiting factor in the northern latitudes, all the more in agroforestry.  
**Constraint** Agroforestry systems in Belgium are too recent to provide substantial shade.  
**Objective** Measure the impact of tree-shade on winter wheat growth and productivity.

## HOW TO SIMULATE TREE SHADE ?

### Artificial shade installation

#### Light treatments



No shade (NS) control plot  
Variable shade (VS) shade following the sun path  
Continuous shade (CS) shade during the whole day

#### Shade period

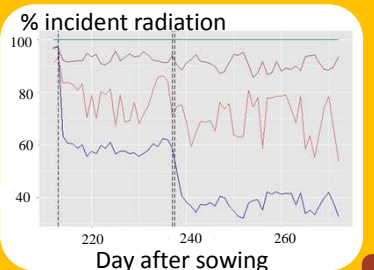
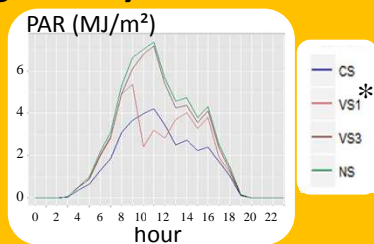
Fit to simulate the shade of walnut trees

- Application of shade during 72 days, 213 day after sowing (DAS)

Densification of shade

- 1 layer of camouflage net from 213 DAS until 237 DAS, 2 layers after 237 DAS until harvest

#### Shade dynamic during the day



\*VS1, VS3 are sensors located at the extremity of the variable shade plot. We use a value of light intensity normalised to its measurement area to analyse crop productivity.

<sup>1</sup> Cumulated incident PAR (%)	CS	VS	NS
At the end of the cropping season	79	88-97	100
During period with shade	47	72-92	100

<sup>1</sup>Incident PAR is expressed in percent of the cumulated PAR in the full sun

## WHAT GROWTH FOR WINTER-WHEAT UNDER SHADE ?

### Agronomic measurements



## ONE YEAR OF RESULTS

### Last sampling of the cropping season :

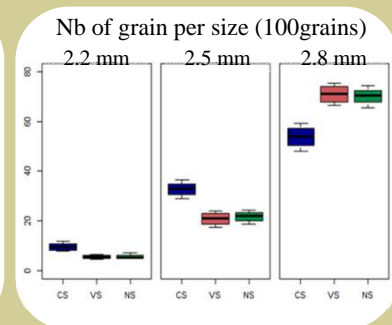
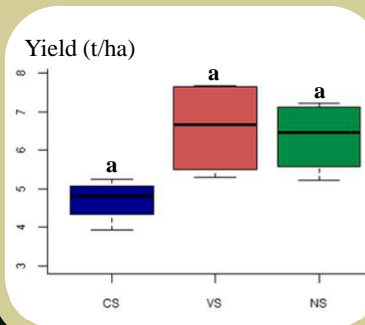
15-07-2014	CS	VS	NS
Straw Biomass (g/m <sup>2</sup> )	693 <sup>a</sup>	466 <sup>b</sup>	449 <sup>b</sup>
Ear Biomass (g per grain)	1.63 <sup>a</sup>	2.10 <sup>a</sup>	1.62 <sup>a</sup>
Grain weight (g/1000grains)	42.3 <sup>a</sup>	46.9 <sup>ab</sup>	46.6 <sup>b</sup>
Protein (%)	13.5 <sup>a</sup>	12.7 <sup>b</sup>	12.3 <sup>b</sup>

### 10-06-2014

Leaf area index	1.66 <sup>a</sup>	2.09 <sup>a</sup>	1.94 <sup>a</sup>
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(ANOVA + Tukey test)

### Harvest : 05-08-2014



## CONCLUSION

- Straw biomass higher under continuous shade.
- **Reduction of wheat yield** under continuous shade.
- Grain size lower under continuous shade : **grain filling disturbed.**
- **Higher protein grain content** in continuous shade.
- Results need to be confirmed by a second year monitoring, as wheat disease and hail may have biased the results.

The continuous artificial shade was similar to the shade of a half-mature (20 cm Diameter at Breast Height) walnut agroforestry plantation at 40 trees/ha (Molto and Dupraz, 2014). A 29% decrease of wheat yield would therefore not be expected before 20 years at least in the Belgium growing conditions for walnut. Therefore, during the first 20 years, the wheat production in the agroforestry alley would be reduced by about 7%.