

# Application of sensors/detectors in intercropping system

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# Introduction









- ❑ Sensors/detectors have been widely used under field conditions to improve our understanding of crop stress level to a wide range of production factors.
- ❑ However, very few reports are available to explain the drivers of intercropping advantage under limited input use.
- ❑ Here we used sensors/detectors to understand the factors driving navy bean-maize intercropping advantage as the level of water and N input decreases.

❑ Evaluation of intercropping system using Land Equivalent Ratio (LER)

❑ LER > 1 - intercropping is more productive

❑ LER < 1 - monocropping is more productive

❑ Intercropping is more productive under low water environments:

Reference:	Crop species	Rainfall (mm)	Grain yield LER
Pilbeam et al., 1994	Bean + Maize	 179	 1.12
Pilbeam et al., 1994	Bean + Maize	 257	 0.84
Belay, 2008	Bean + Maize	 541	 1.40
Belay, 2008	Bean + Maize	 763	 1.10

# Methodology

- ❑ Navy bean – maize intercropping systems and their sole crops were evaluated under three levels of input use
  - ❑ low water/nitrogen (W/N)
  - ❑ medium W/N
  - ❑ high W/N
- ❑ Automatic rainout shelters were used to control rainfall





# Sensors/detectors

- ❑ SunScan canopy analyser system
- ❑ Neutron soil moisture meter
- ❑ Infra-red thermometer
- ❑ Humidity and temperature sensors

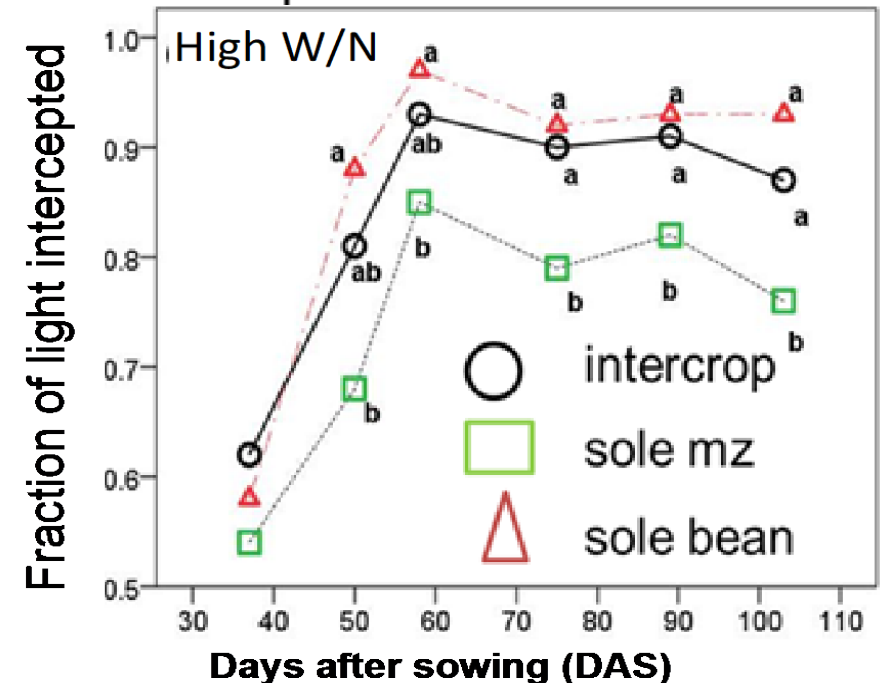
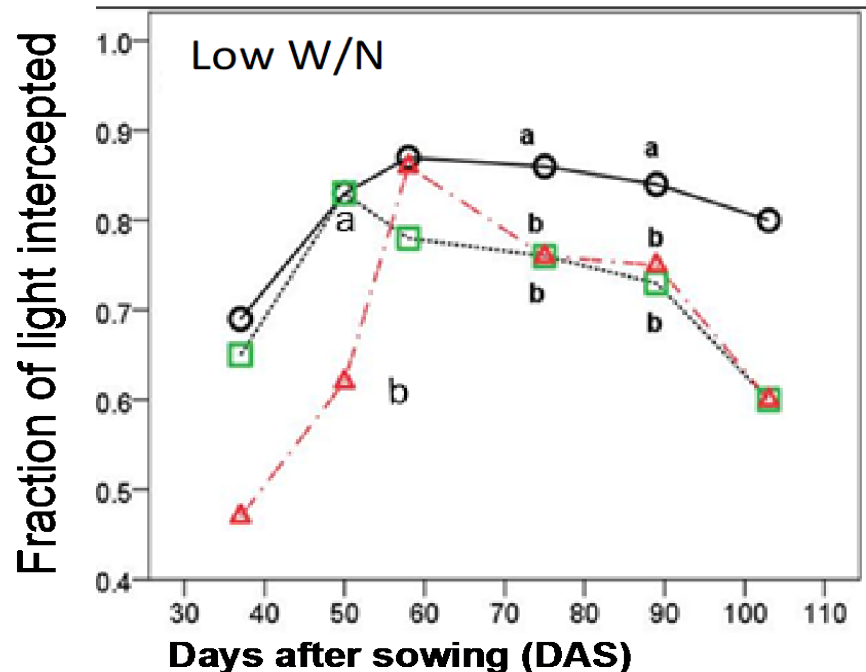
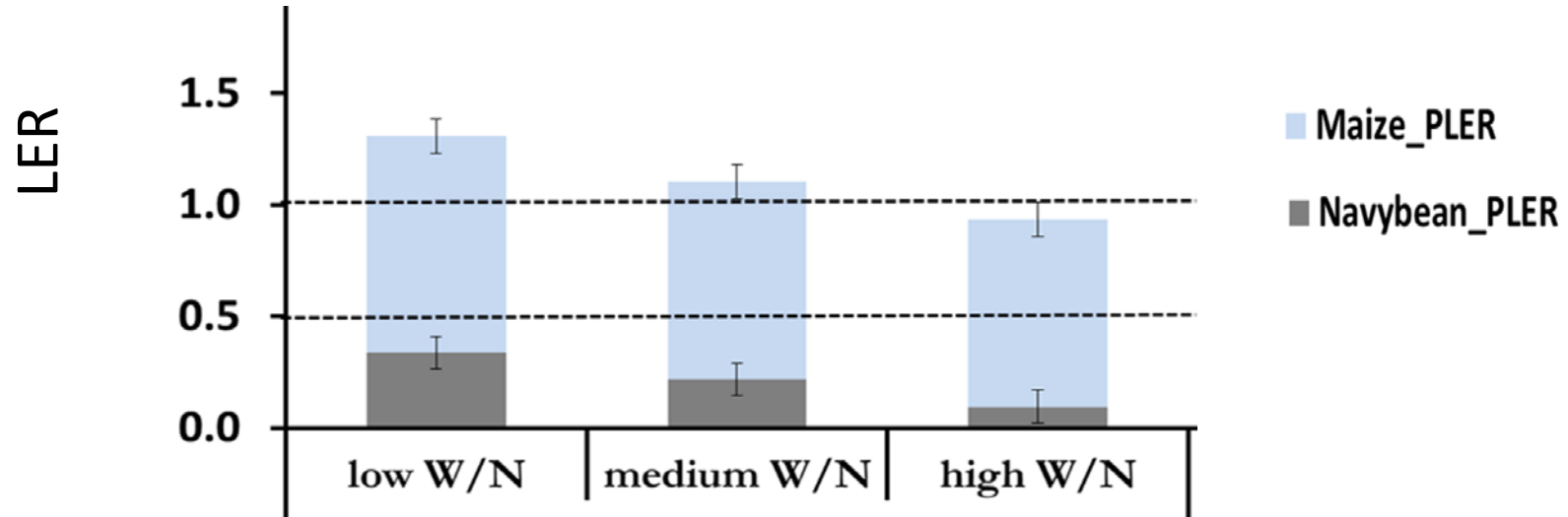
## Analysis

- ❑ Land equivalent Ratio
- ❑ Light capture
- ❑ Canopy stress index (CSI)
- ❑ Water capture and use efficiency
- ❑ N capture and use efficiency



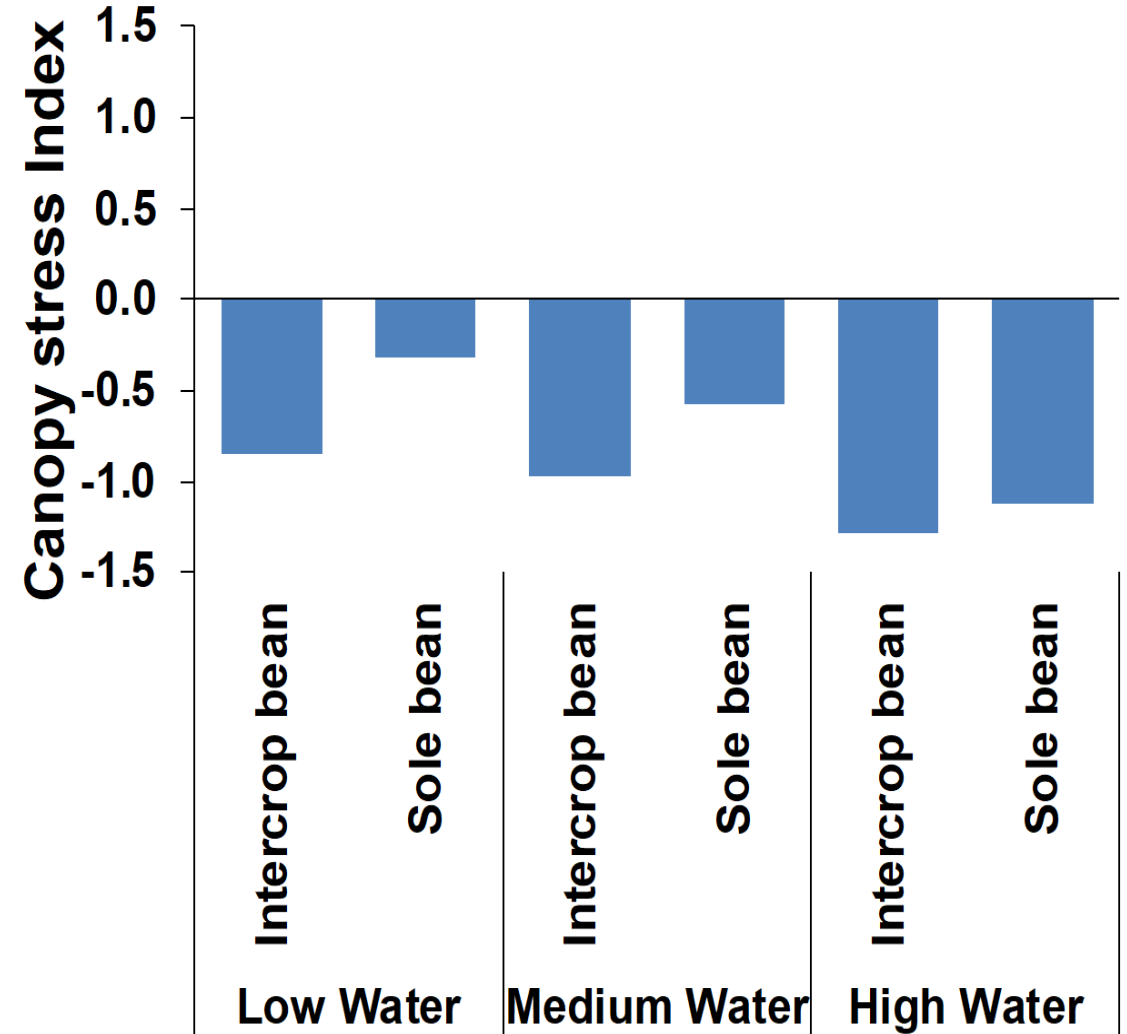
# Results

## Land Equivalent Ratio (LER) and Fraction of Light Interception



# Canopy stress index ( $^{\circ}\text{C}$ /kPa)

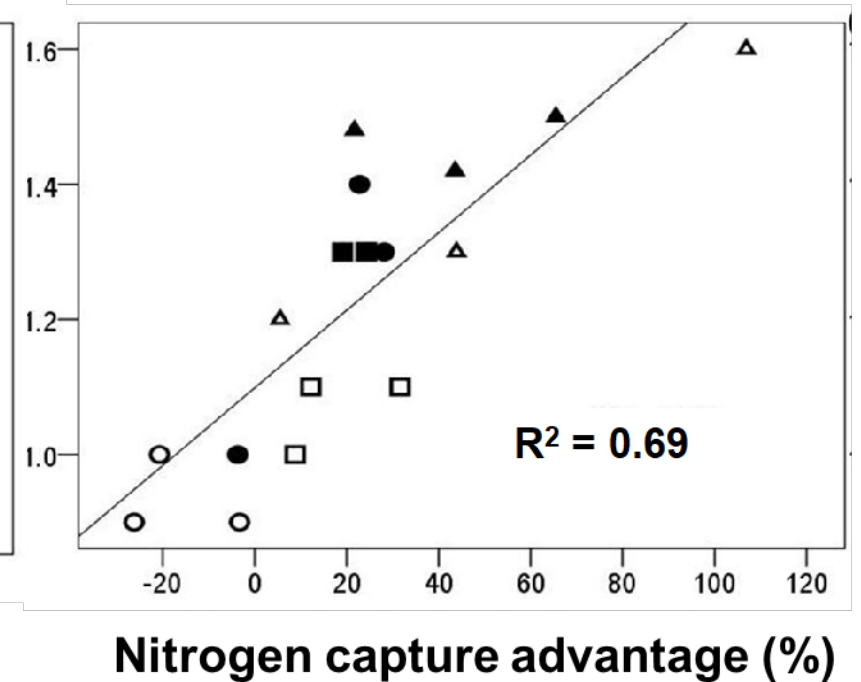
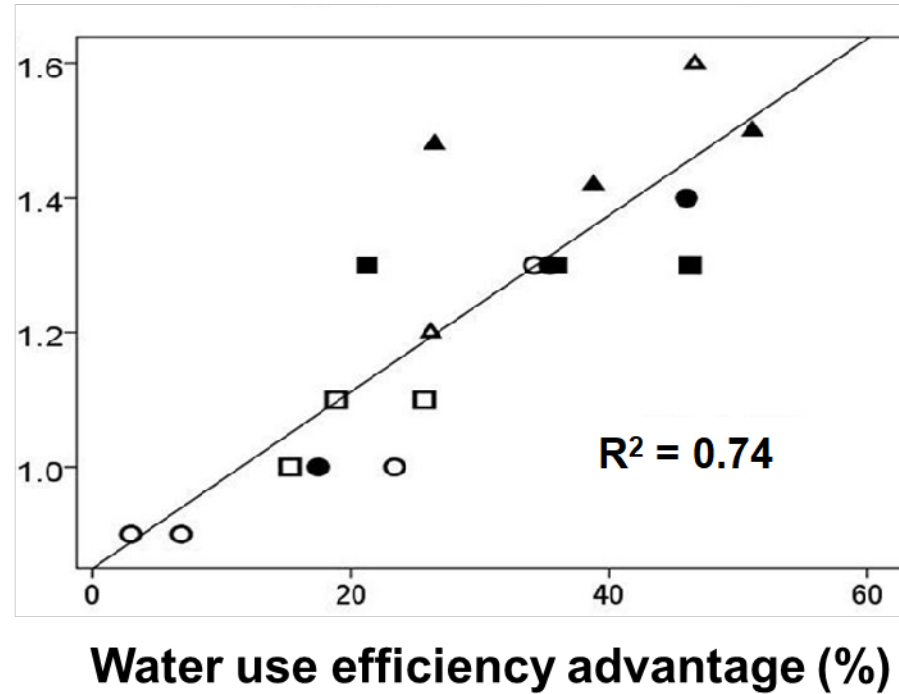
- Canopy temperature
- Air temperature
- Vapor pressure deficit



# The relationships between LER and Water, Nitrogen and light capture and use efficiency

Factors	Significant level (p<0.05)
WC	ns
WUE	*
NC	*
NUE	ns
LC	ns
LUE	ns

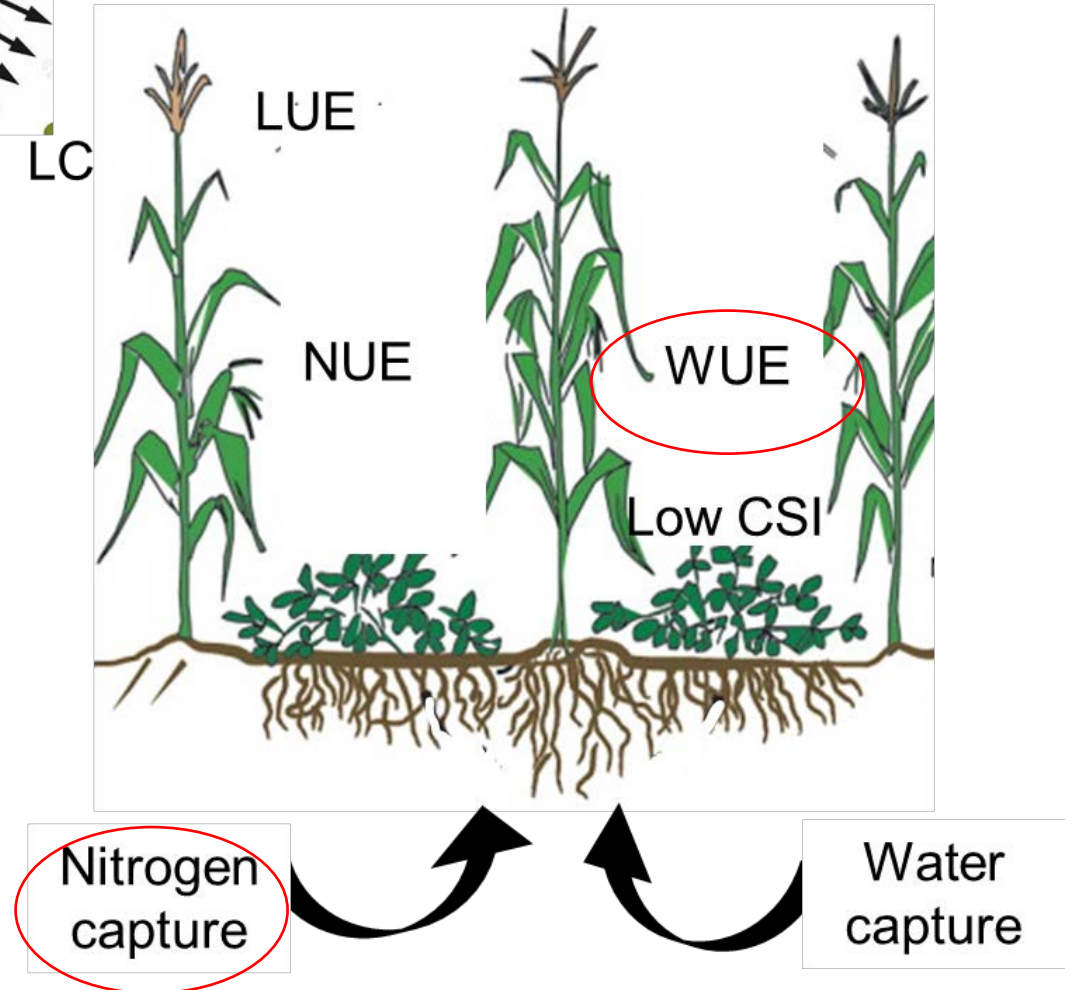
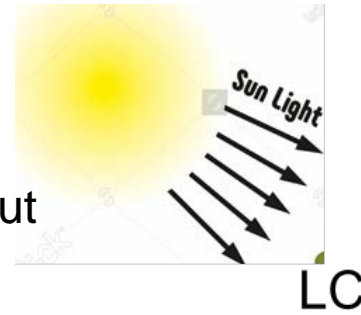
Land Equivalent Ratio (LER)





# Conclusions

- ❑ Intercropping is productive in low input environment.
- ❑ Intercropping system intercepted higher fraction of light than monocropping under limited water and N conditions.
- ❑ intercropping of navy bean with maize might have maintained navy beans temperature in a water stressed environment.
- ❑ LER is driven by water use efficiency and N capture.
- ❑ Sensors/detectors appear to be applicable in explaining factors driving intercropping advantage.



# Acknowledgements

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