The challenges of agricultural production in a future variable and changing climate

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Climate variability and change impacts on agricultural production

- Dearth of agricultural impact assessments at a range of scales few explore the value of adaptation.

Generalised global scale studies

Seek necessary but sufficient complexity to inform decisions

Complex sets of case studies without generalisation
Uncertainty in agricultural productivity 2030

Farm incomes 2030

Pasture growth 2030

Uncertainty across emissions scenarios & models

Variability = $\frac{90p - 10p}{50p}$

• The level of uncertainty associated with current projections means that the value of adaptation options must be demonstrated both now and into the future – a sensitivity approach.

Nelson et al., 2010
Combining expert knowledge with Modelling – Farmer interviews

**Some Tactical decisions are:**
- Crop variety and rotation.
- Area devoted to crop or pasture.
- Amount of fertiliser.
- Amount of herbicides for weed control prior to crop establishment.
- Marketing, forward selling, yield estimates.
- Animal husbandry issues, feed supply and quality, water supply.

**Intra-seasonal decisions can include:**
- Whether to top-dress with added fertiliser to take advantage of better growing conditions.
- Whether to de-stock because of poor pasture growth or lack of water.
Combining expert knowledge with Modelling – Modelling (APSIM)

Flexible Management

- Weeds
- SoilN
- SurfaceOM

Crop Physiology
Maize, Wheat, Barley, Sorghum, Sugarcane
Sunflower, Canola, Chickpea, Mungbean, Cowpea, Soybean, Peanut, Stylo pasture
Lucerne, Cotton (OzCot), Native pasture (GRASP), Hemp, Sweet Potato, etc.

General simulation framework:
- A solid platform for modelling the “system” performance over time
- Equal emphasis on crop and soil dimensions of agricultural systems
- Capability to deal comprehensively with management matters including different crop rotations, mixtures + fallowing
- Short or long term effects
Combining expert knowledge with modelling – testing adaptation options

Benchmark / validation

Long-term simulations / validation

Crop yield scenarios

Gross Margin scenarios
Adapting to change – testing CC adaptation options: Nitrogen
Adapting to change – testing CC adaptation options: fallows
Adapting to change – testing CC adaptation options: Lucerne
Combining expert knowledge with modelling – testing adaptation options

- Stubble management, fallowing, row spacing, changing cultivars, split fertiliser
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- Stubble management, fallowing, split fertiliser
Conclusions

• Our research has shown that local expert knowledge and modelling can be combined to examine the value of adaptation from local to regional scales.

• The regional variability of adaptation results shows clearly that local knowledge will be required to adapt to projected changes and hence combining local expert knowledge and modelling is a crucial activity.

• The prospect of adapting to significant climate change remains challenging, and achieving doubled yield production within 40 years would seem remote with significantly new and innovative adaptation.
Thank you

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