Some traits make farming systems more vulnerable to uncertain climate than others

Gus Rose, Han Mulder, Johan van Arendonk and Andrew Thompson
Sheep farming is not easy
Mediterranean – uncertain climate
Variation within year

Pasture growth (kgDM/ha per day)

Month

Mar
Jun
Sep
Dec

- $
Pasture growth varies across years
Objective

- Does variation of pasture and across years affect profit?
- What traits should we breed for?
Optimising profit

Brooke, Drud, and Meeraus linear program (BDMLP in GAMs)
Model of a sheep

- Energy
- Maintenance
- Growth
- Wool
- Pregnancy
- Lactation
Sampling pasture growth across years

Distribution of pasture growth from last 20 years
Sampling pasture growth across years

Pasture growth

Month

500 times
Many different combinations
Looping through years
Filtering average and extreme years

Average consistent years versus Extreme years

Average pasture growth

5 10 15 20 5 10 15 20 5 10 15 20

Average pasture growth

5 10 15 20 5 10 15 20 5 10 15 20

versus
Average pasture growth over three years

- Average years: (Average = 9.79)
- Extreme years: (Average = 9.82)
Extreme years change profit

- Average years (Average = $942)
- Extreme years (Average = $857)
Traits

**Live weight** - energy, intake, meat income

**Longevity** – flock structure

**Wool weight** – energy, wool income

**Lambs weaned** – flock structure, energy
Relative importance the same

Average years

- Weight
- Longevity
- Wool
- Lambs

Extreme years

Economic value $/genetic standard deviation
Take home messages

- Varying pasture growth across years affects profit

- Average relative value of traits not affected by varying pasture

- Economic values vary when pasture growth varies
  - Potential to change economic values?
Relative importance does not change
Low medium and high rainfall

- Red: Bad years
- Black: Average years
- Blue: Good years

Profit ($)

500 1000 1500
Profit affected by pasture growth
Stocking rate more important than grain

Average grain feed (kg/ha/month) vs Average stocking rate (sheep/ha/month)

Profit vs Stocking rate
Economic values affected change

Bad years

Average years

Good years

Wool

Lambs

Economic value $/genetic standard deviation
Variation also changes
Variation of traits does change
Model stats

- Iterations 159000
- Time 27 minutes
- Blocks of equations 19
- Single equations 71,549
- Blocks of variables 12
- Single variables 172,289
- Non zero elements 502,785
82 age groups
6 categories for reproduction

0 lambs born
0 lambs weaned
1

1 lamb born
0 lambs weaned
2
1 lamb weaned
3

2 lambs born
0 lambs weaned
1 lamb weaned
4
2 lambs weaned
5
1 lamb weaned
6
Two sexes
Sheep eats grass and grain
Model sheep farm

Number of sheep limited by the amount of grass on the farm
Model sheep farm

Increase feed intake or decrease pasture = Less sheep or more grain = Less profit
Always included average pasture growth