BASQUE CENTRE FOR CLIMATE CHANGE
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Heat stress effects in milk yield and milk traits at farm scale

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Modelling Grassland-Livestock Systems under Climate Change
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Potsdam, Germany

OptiBarn

Objective

- **How effective and practical are the optimisation approaches?**

- In the framework of the ERANET+ project 

our aim is to assess three potential impacts of climate change at **farm-scale** in dairy cow systems: welfare, economic costs and emissions

SIMSDAIRY

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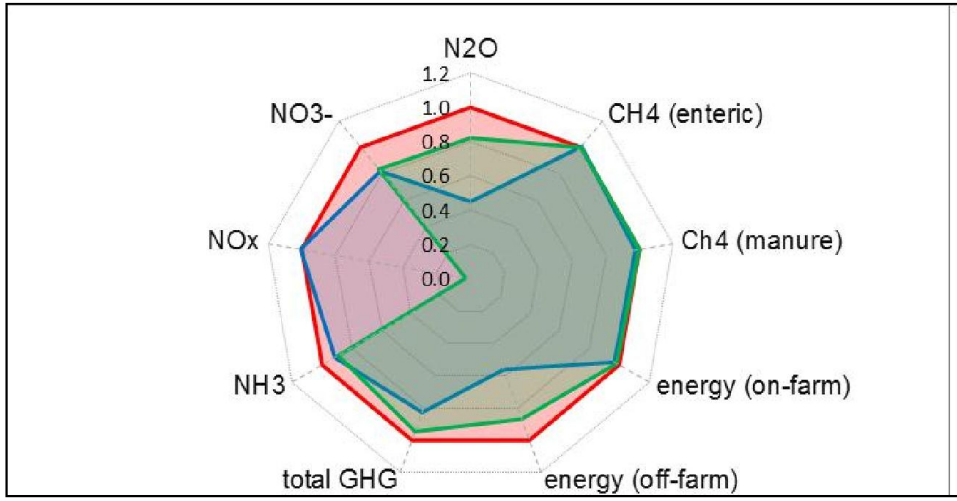
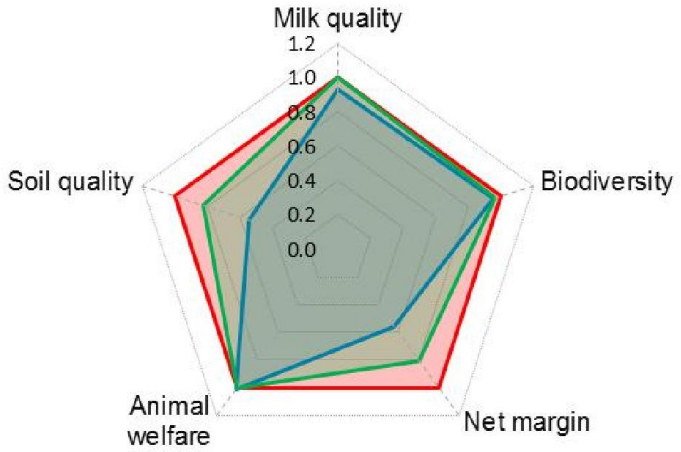
GEIs, NH3, NO3-…



Sustainability attributes



- BAU
- Optimal barn modification
- Optibarn+other strategies

Values <1 improve conventional farm results

Adapted from Del Prado et al., 2011

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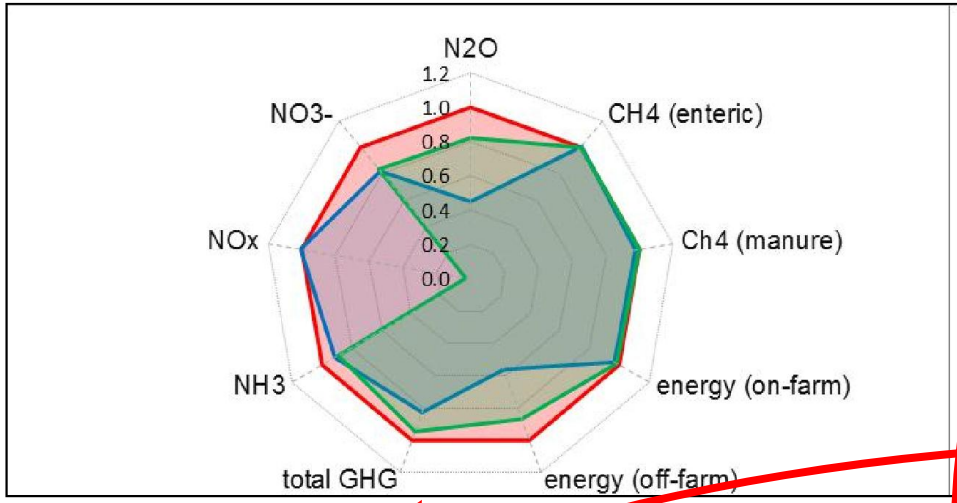

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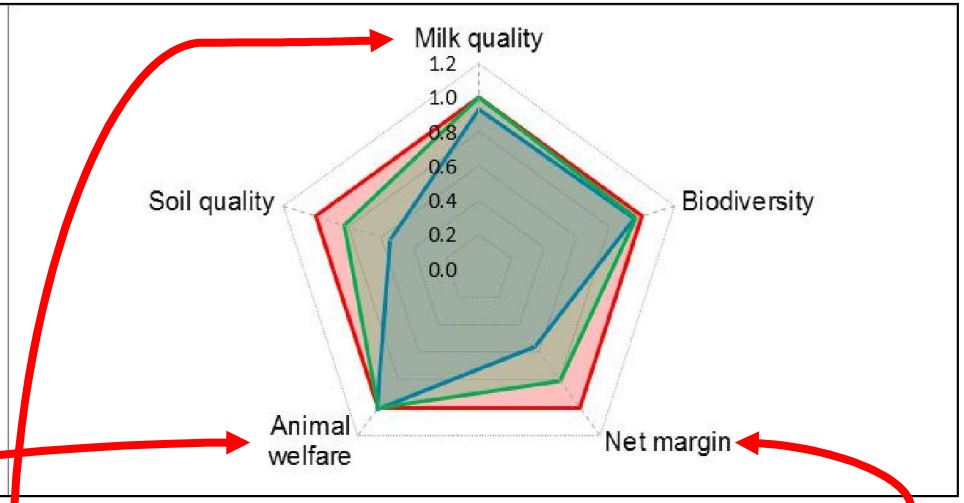

Warm temperatures

- Milk
- Reproductive performance → Culling rate
- Health
- Survival

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- Barn modifications
- Heat abatement structures
- Herd management (seasonality)
- Diet
- Other technologies

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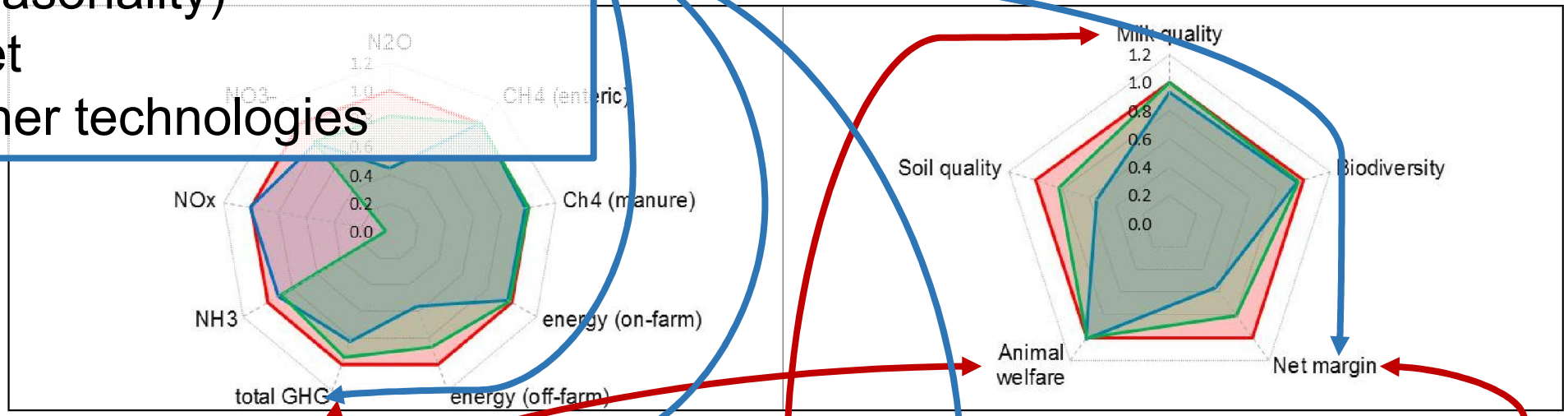

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Initial scenario: southern Spain

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Semi-arid areas barns are loose and open

Heat stress management practices

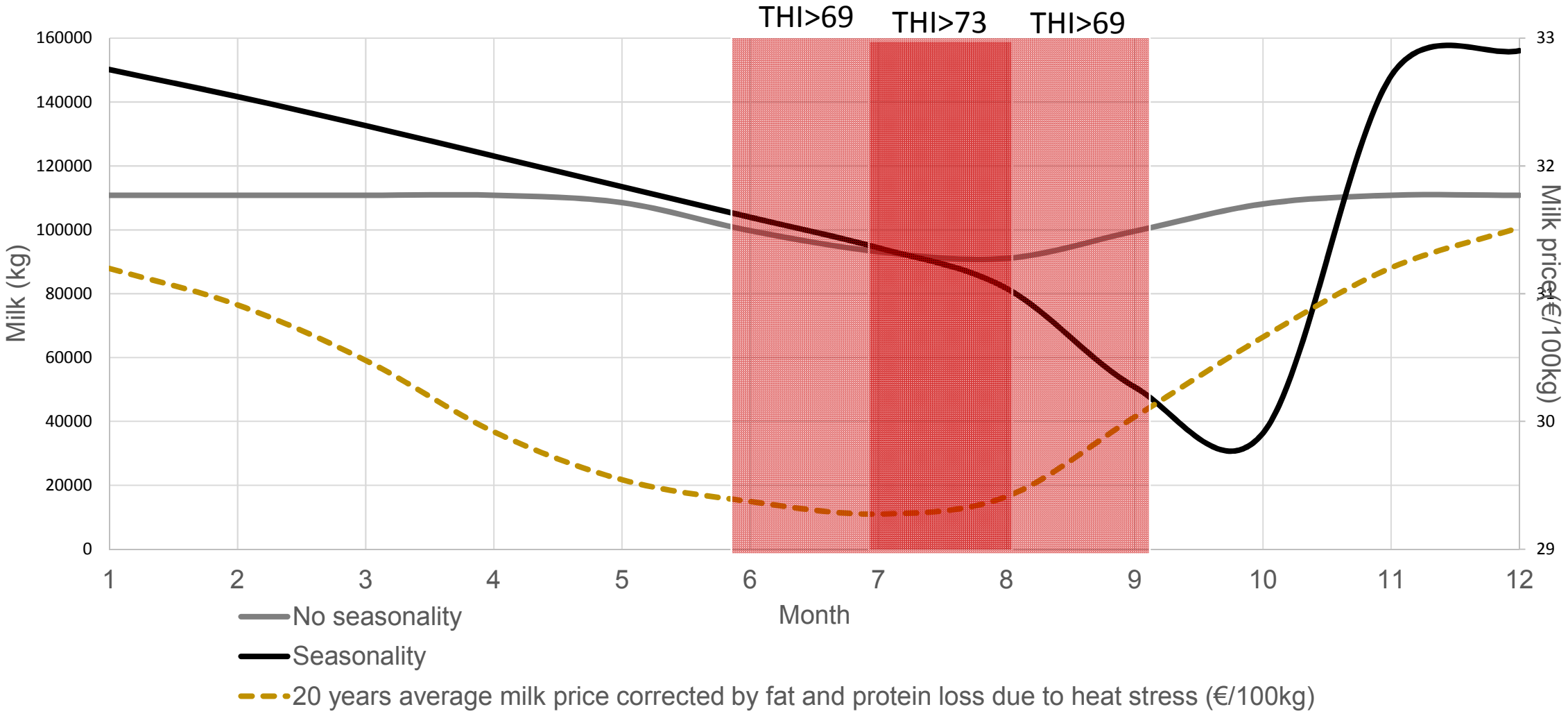
Initial scenario: methods

- Daily **THI**: 20-years (1995-2014) data from Valencia airport (AEMET)
- Yield loss: St-Pierre et el. (2003)
- Milk traits: Carabaño et al. (2016)
- Monthly **prices**: 20-years (1995-2014) for Spain (Milk market observatory, 2016)
- Simulated farm: 100 cows

  "**No seasonality**": constant calving season

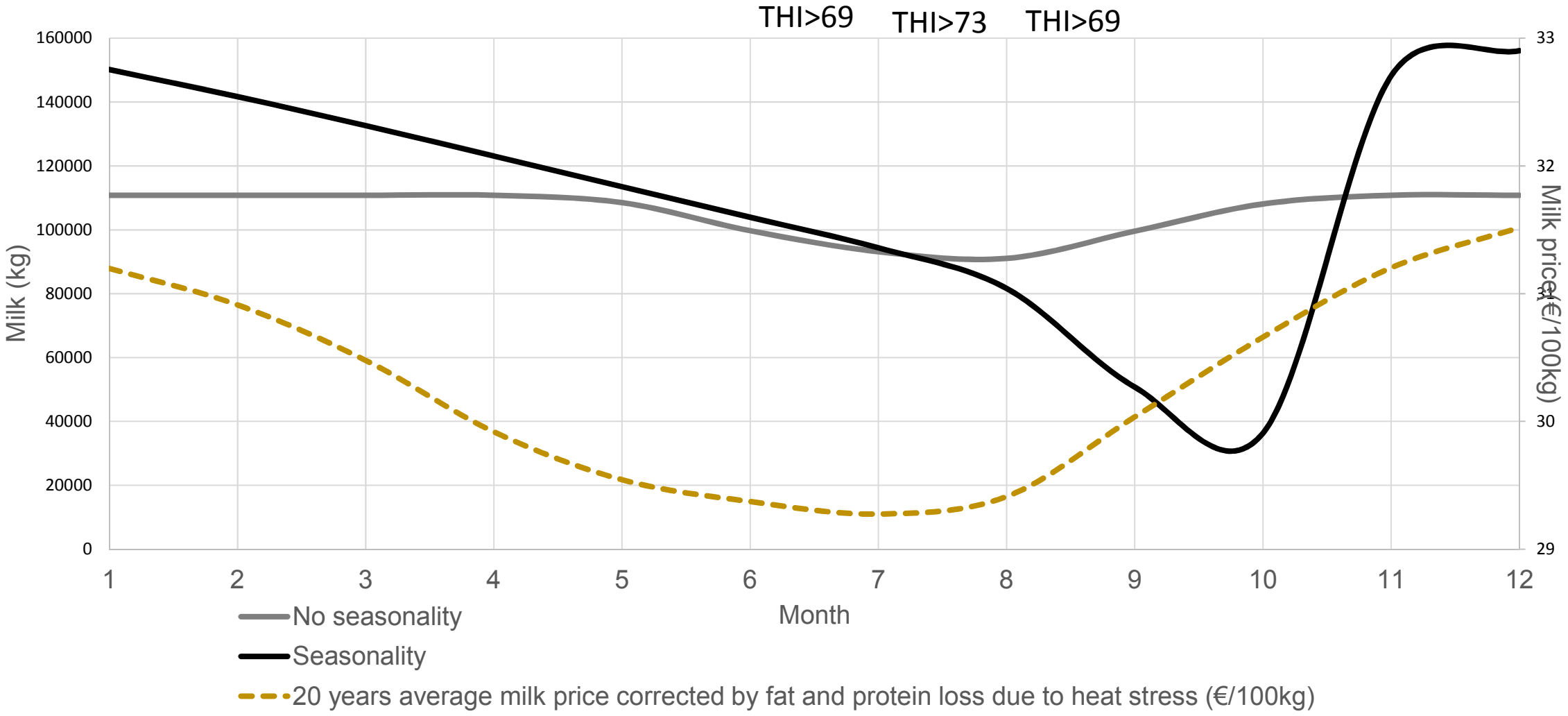
  "**Seasonality**": lactation of 25 cows started October and 75 in November to avoid insemination and lactation peaks in summer months

Farm production scenarios in southern Spain



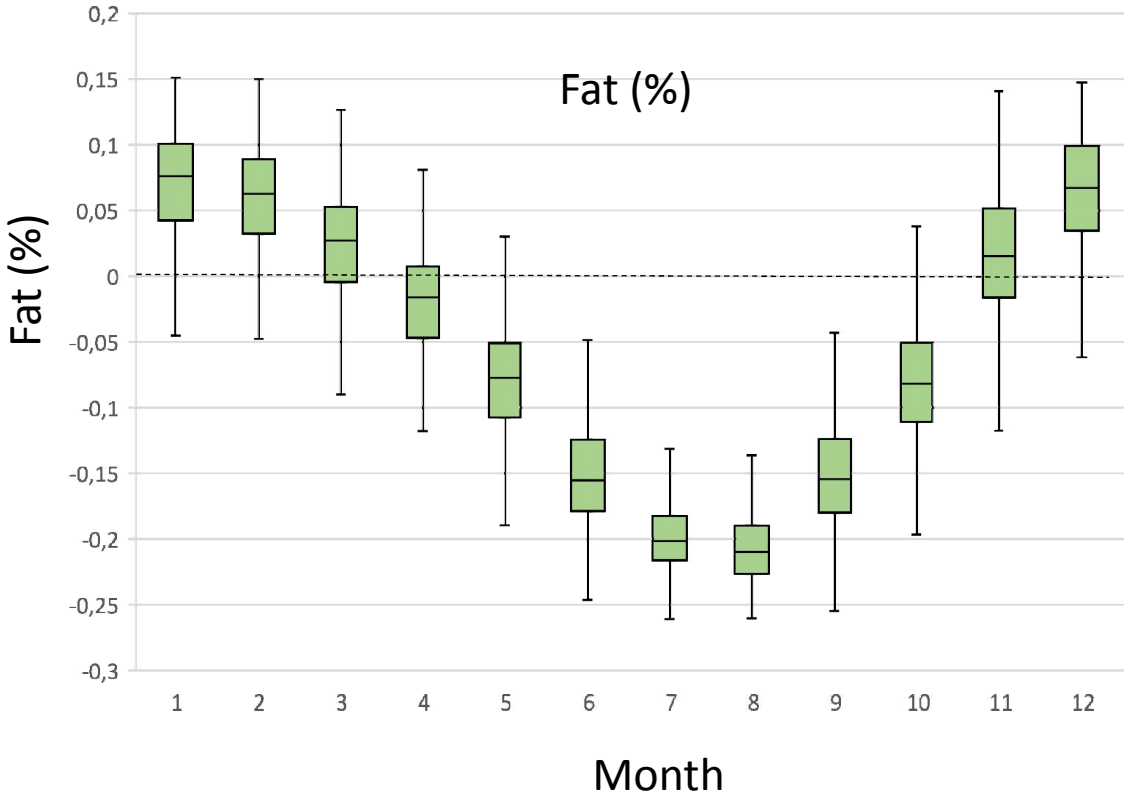
Source: AEMET, St-Pierre et al. (2003) and Milk market observatory (2016)

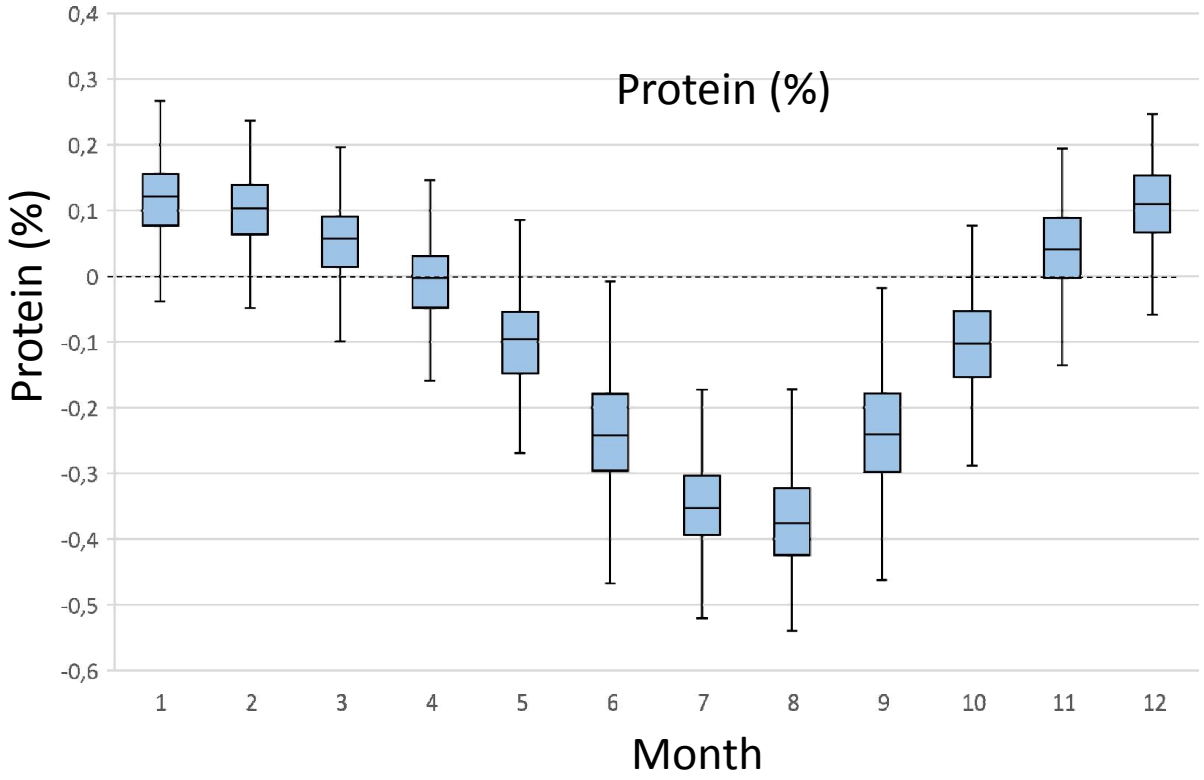
Farm production scenarios in southern Spain



Source: AEMET, St-Pierre et al. (2003) and Milk market observatory (2016)

Milk traits





Source: AEMET, Carabaño et al. (2016)

Results

- Seasonality scenario produces annually 5.3% more milk than the scenario without seasonality because cows exposed to highest THI are either dry or in late lactation.
- Prices the last 20 years have been lower in summer months. Hence, the difference of annual farm income increases up to 5.7% when combined with the effect on fat and protein percentages losses.
- This difference is likely to increase. E.g. effect of heat stress in conception rates is not included yet, it can drop to 10% (Schüller et al. 2014)

Conclusion

- Combination of heat abatement structures with herd management techniques such as seasonality on calving reduces the effects of heat stress in milk yield at farm scale
- Hence, we need to design scenarios to simulate the combined effect these (and other) common techniques
- Future scenarios are needed to predict the effects of climate change in farm economy, also taking into account reproductive performance, welfare, death rates and farm emissions