LfL

Bavarian State Research Center
for Agriculture

Linking environmental models and economic tools for trade-off analysis – A German case study

Zehetmeier, M., Reindl, A., Karger, V., Strobl, M., Müller, U.K., Dorfner, G., Kapfer, M.

„IDB-Calculator“- Bio-Economic Decision Support Tool

Basic information on the production process

Breed : Simmental

Replacement rate : 30.0 %

Calving interval : 393.0

Stock supplement via :

First calving in own stock: 0.0 %

Calves loss rate: 7.3 %

Calves per cow and year: 0.86

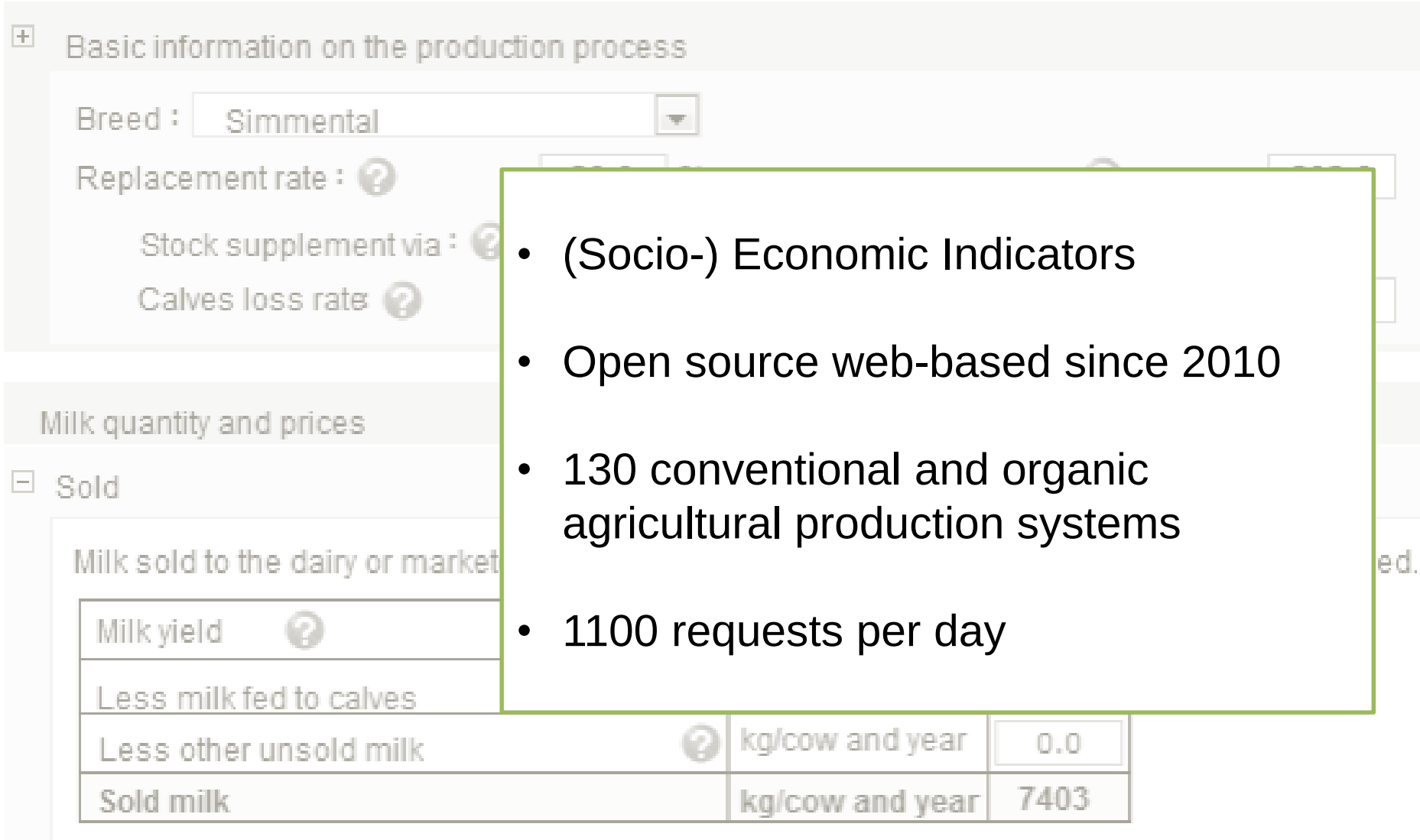
Milk quantity and prices

Sold

Milk sold to the dairy or marketed directly. On average, 85-95% of the milk produced is marketed.

Milk yield	kg/cow and year	7451.0
Less milk fed to calves	kg/cow and year	48.2
Less other unsold milk	kg/cow and year	0.0
Sold milk	**kg/cow and year**	**7403**

„IDB-Calculator“- Bio-Economic Decision Support Tool



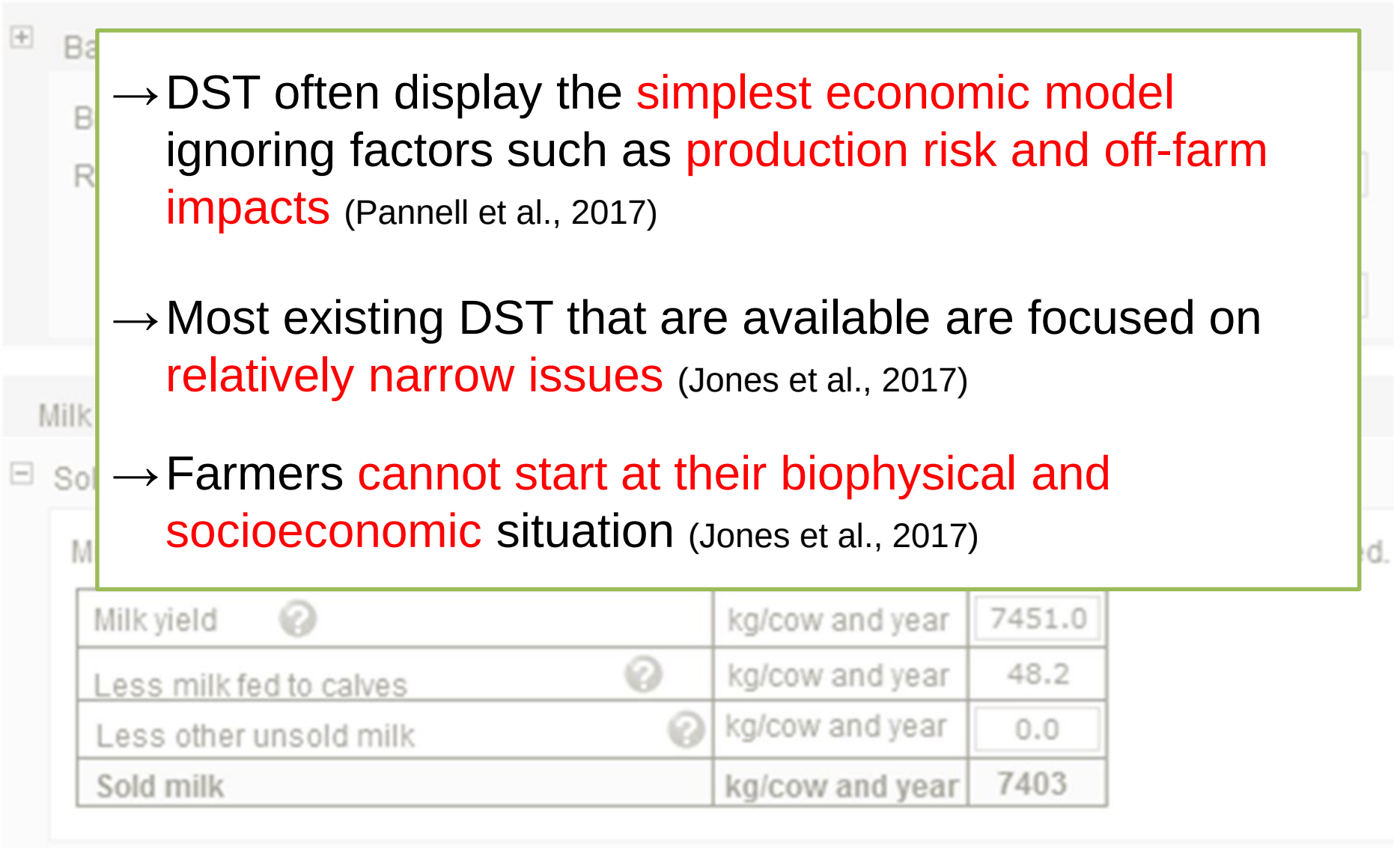
- (Socio-) Economic Indicators
- Open source web-based since 2010
- 130 conventional and organic agricultural production systems
- 1100 requests per day

The Problem

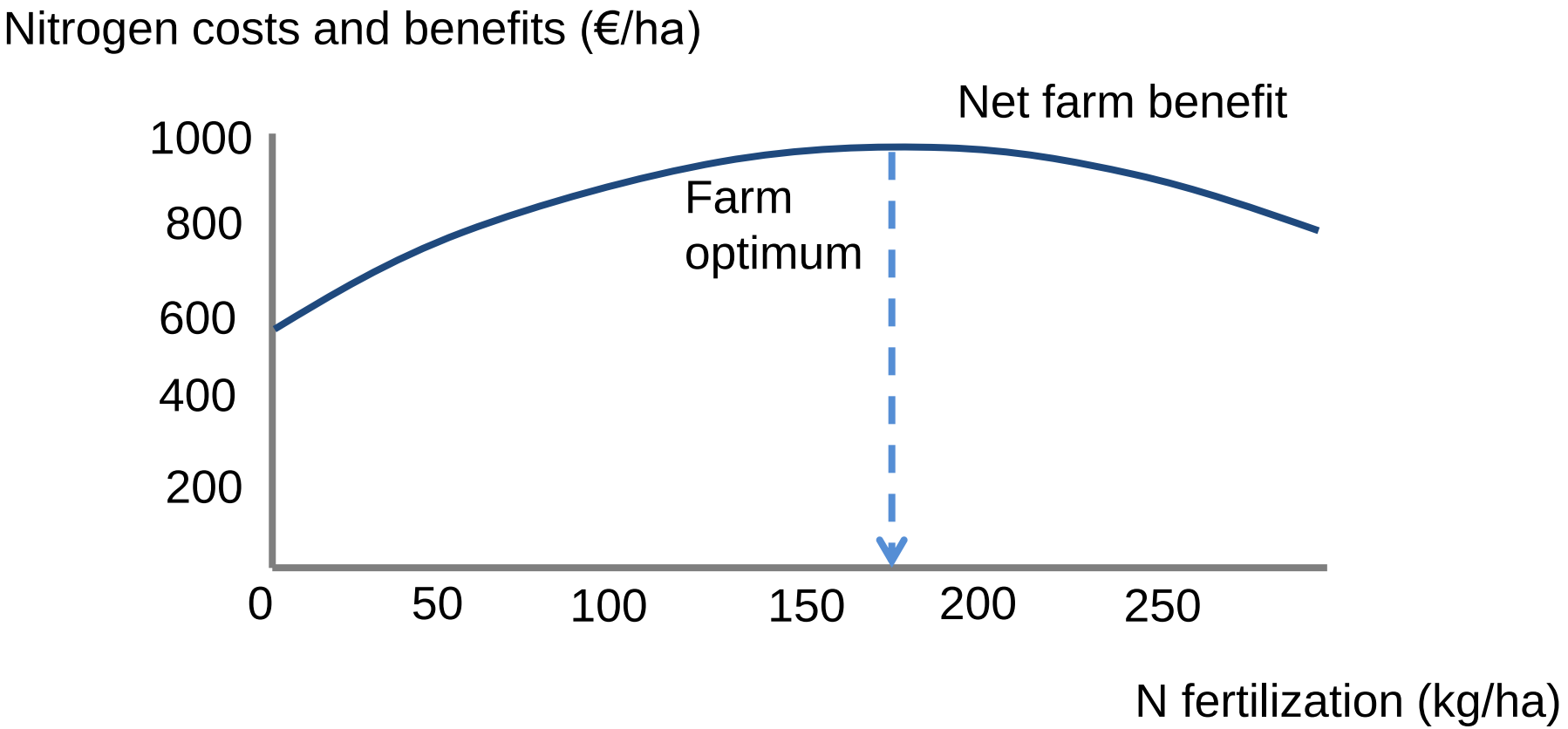
→ DST often display the simplest economic model ignoring factors such as production risk and off-farm impacts (Pannell et al., 2017)

→ Most existing DST that are available are focused on relatively narrow issues (Jones et al., 2017)

→ Farmers cannot start at their biophysical and socioeconomic situation (Jones et al., 2017)



Nitrogen input, farm benefit and additional costs



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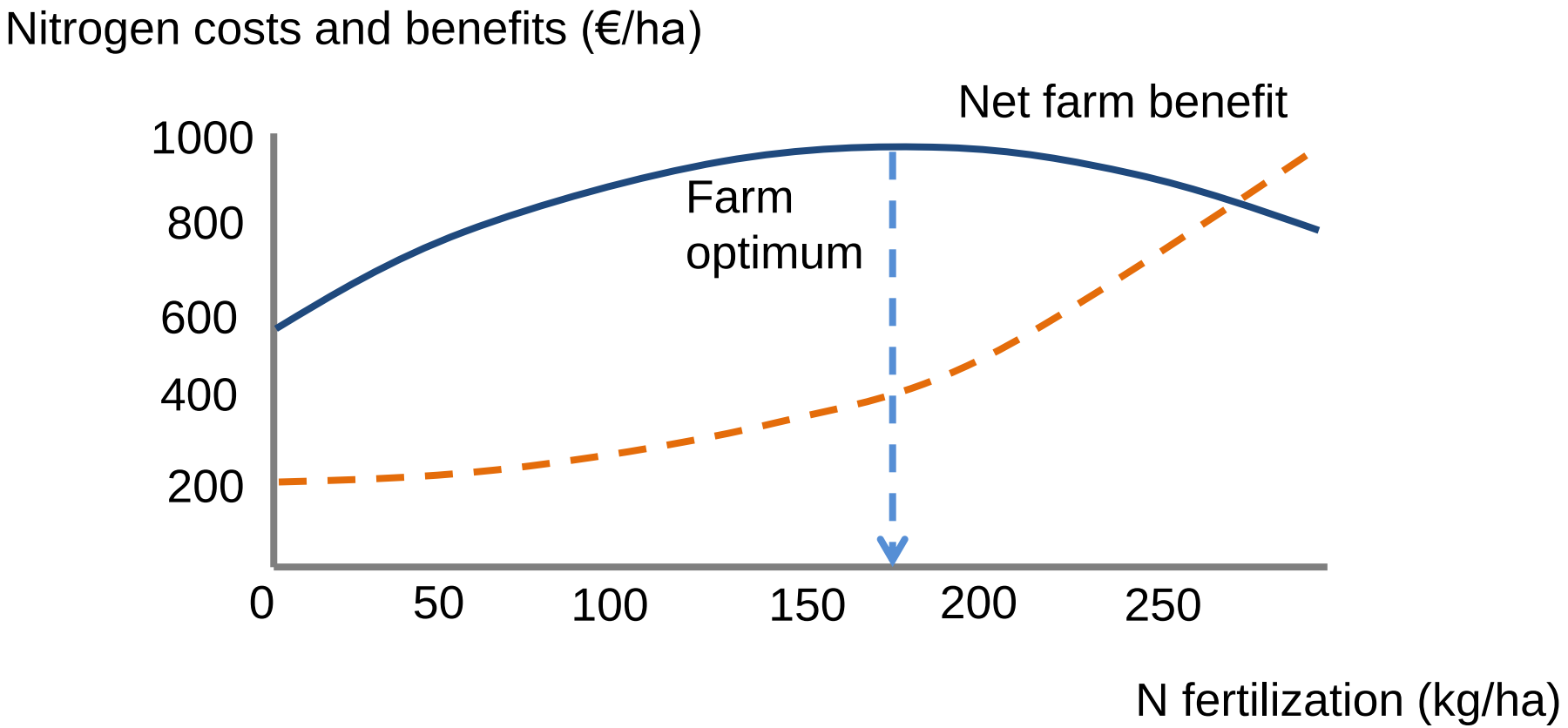

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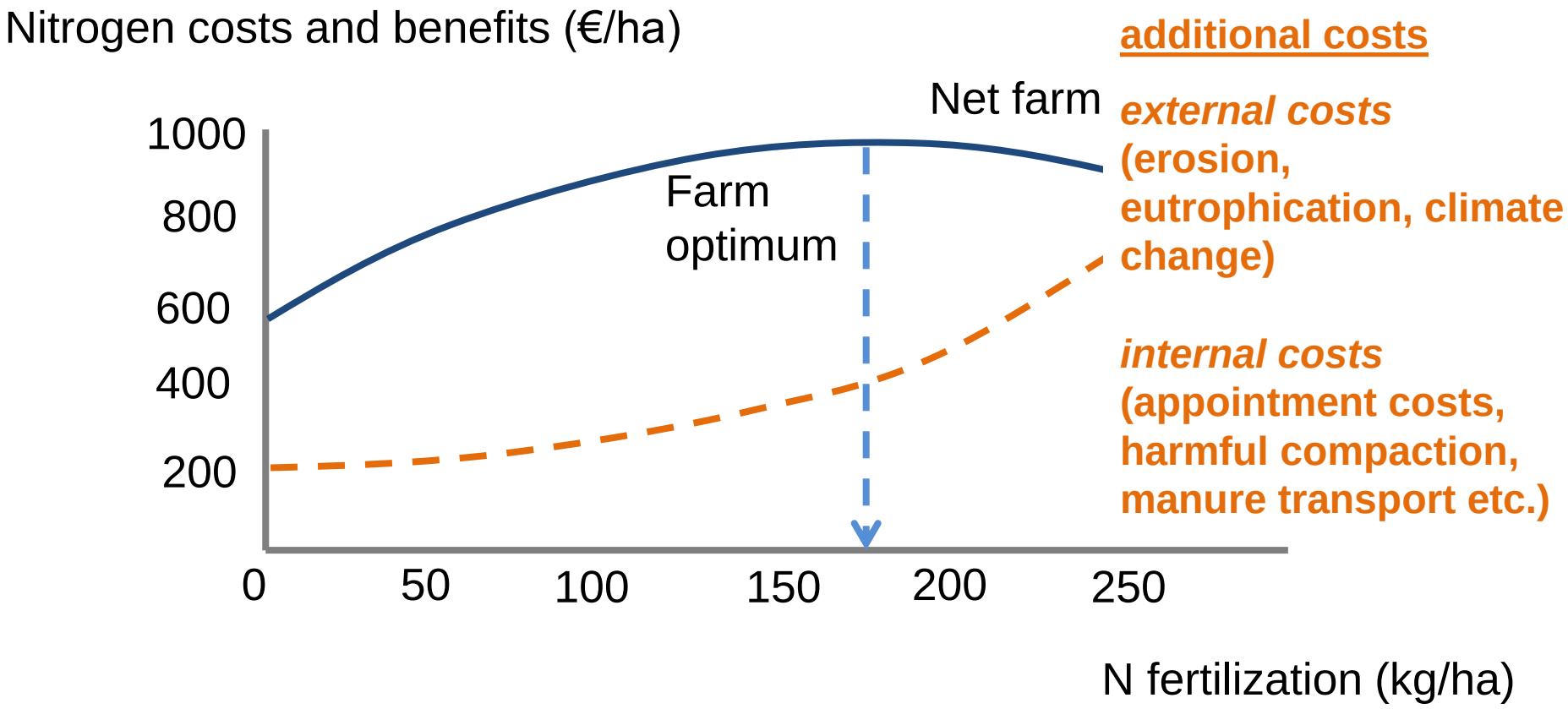

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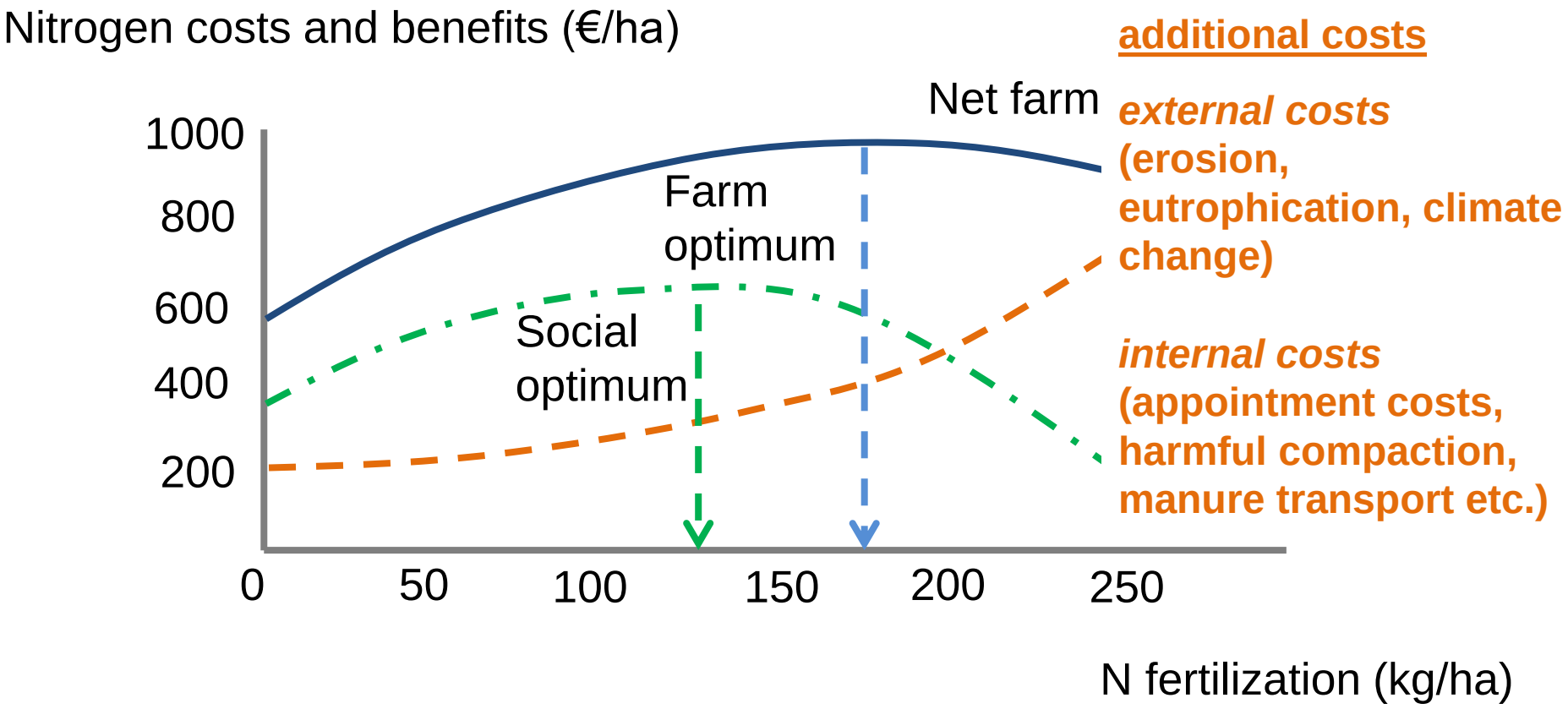

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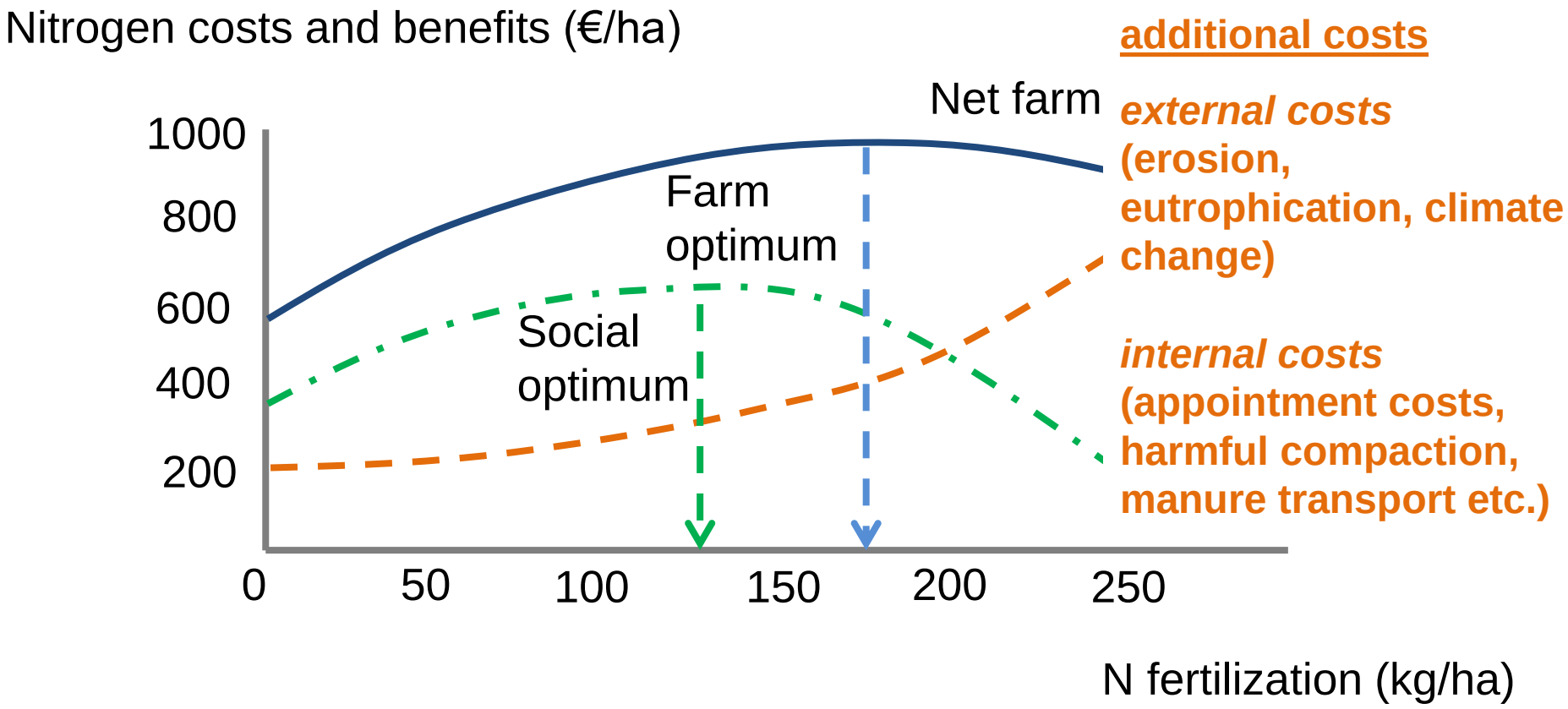

amount of input, field length, crop ratio, herd size, stocking rate, milk yield

Van Grinsven, 2013

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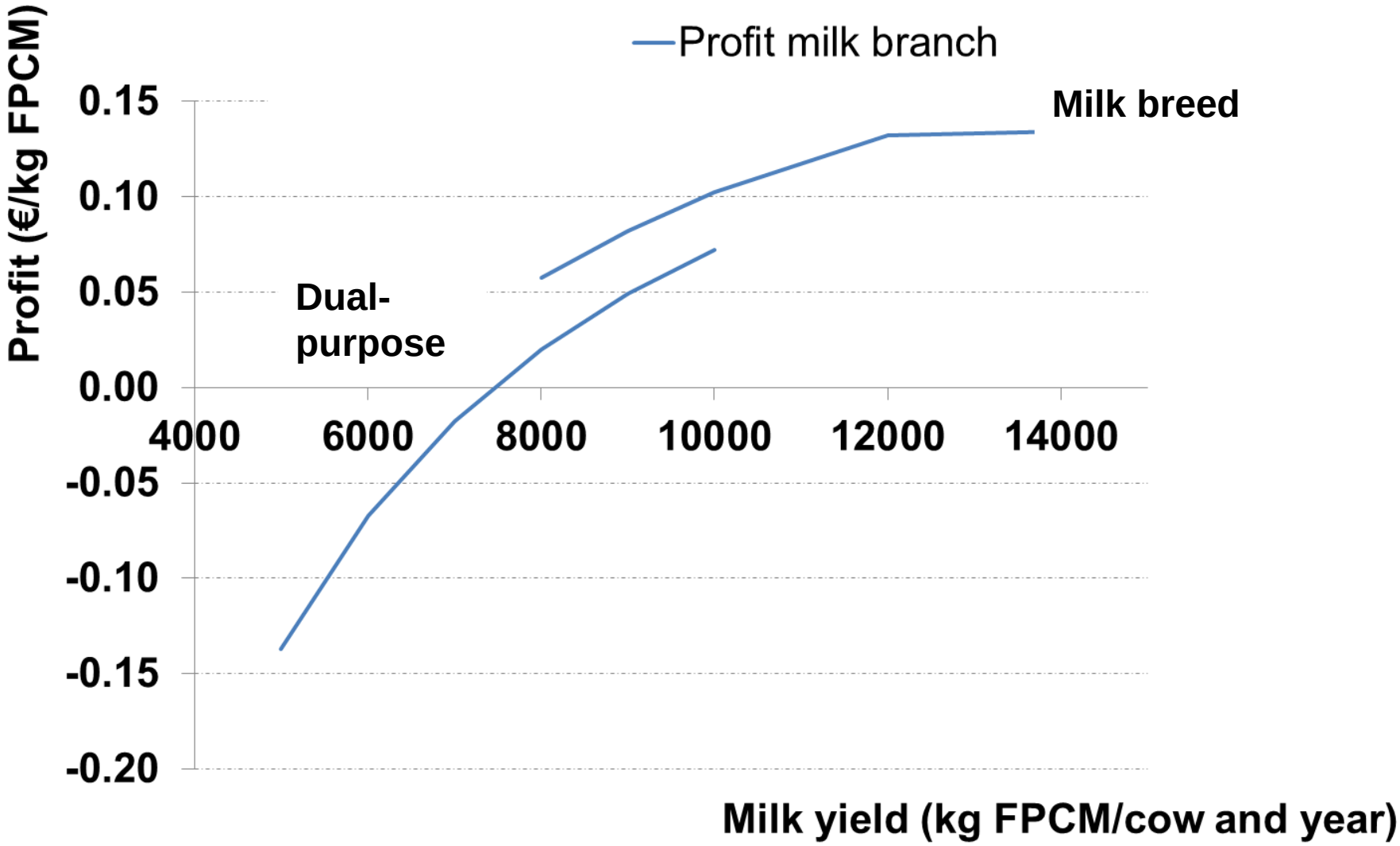
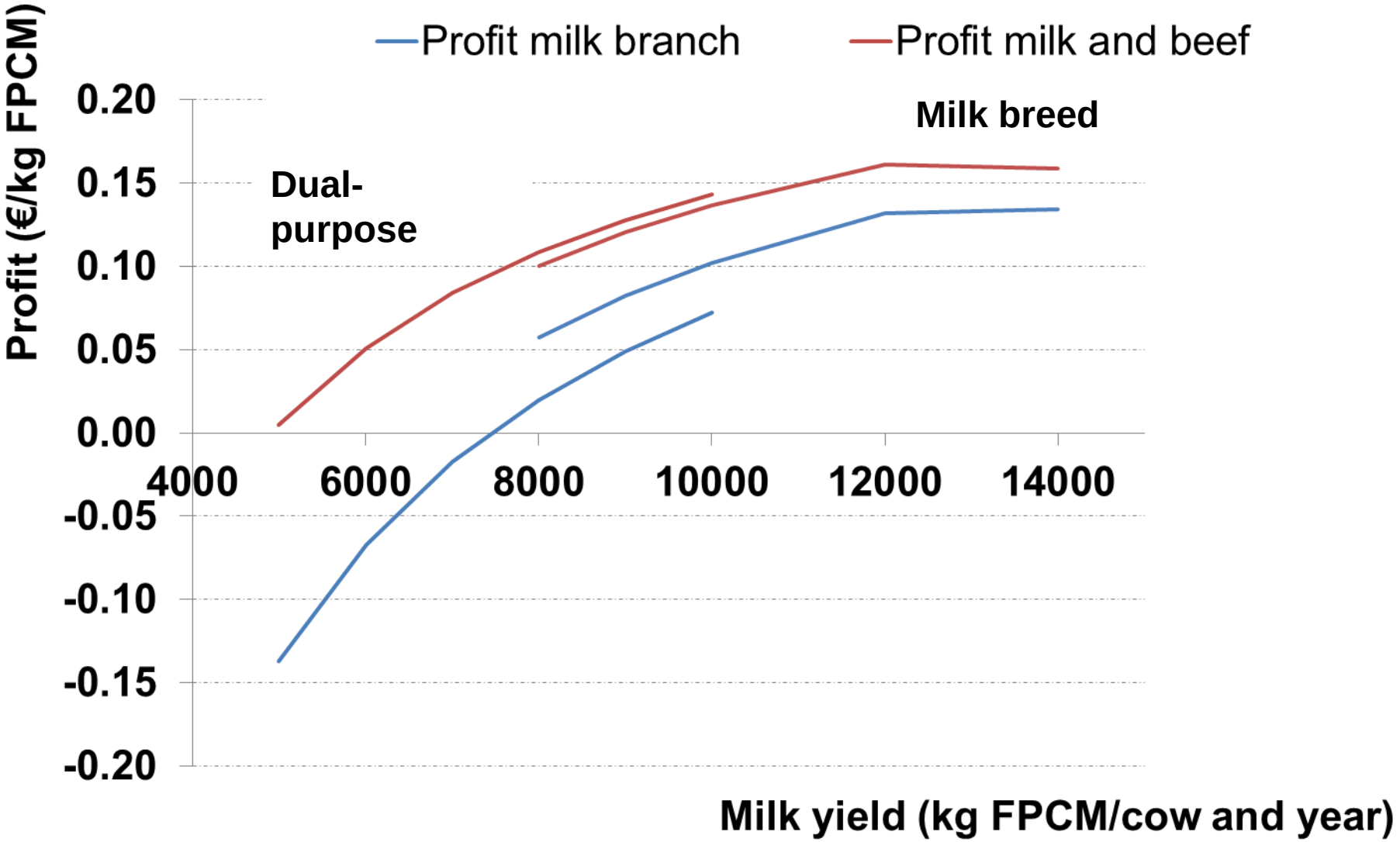
Milk yield and profit



Milk yield and profit



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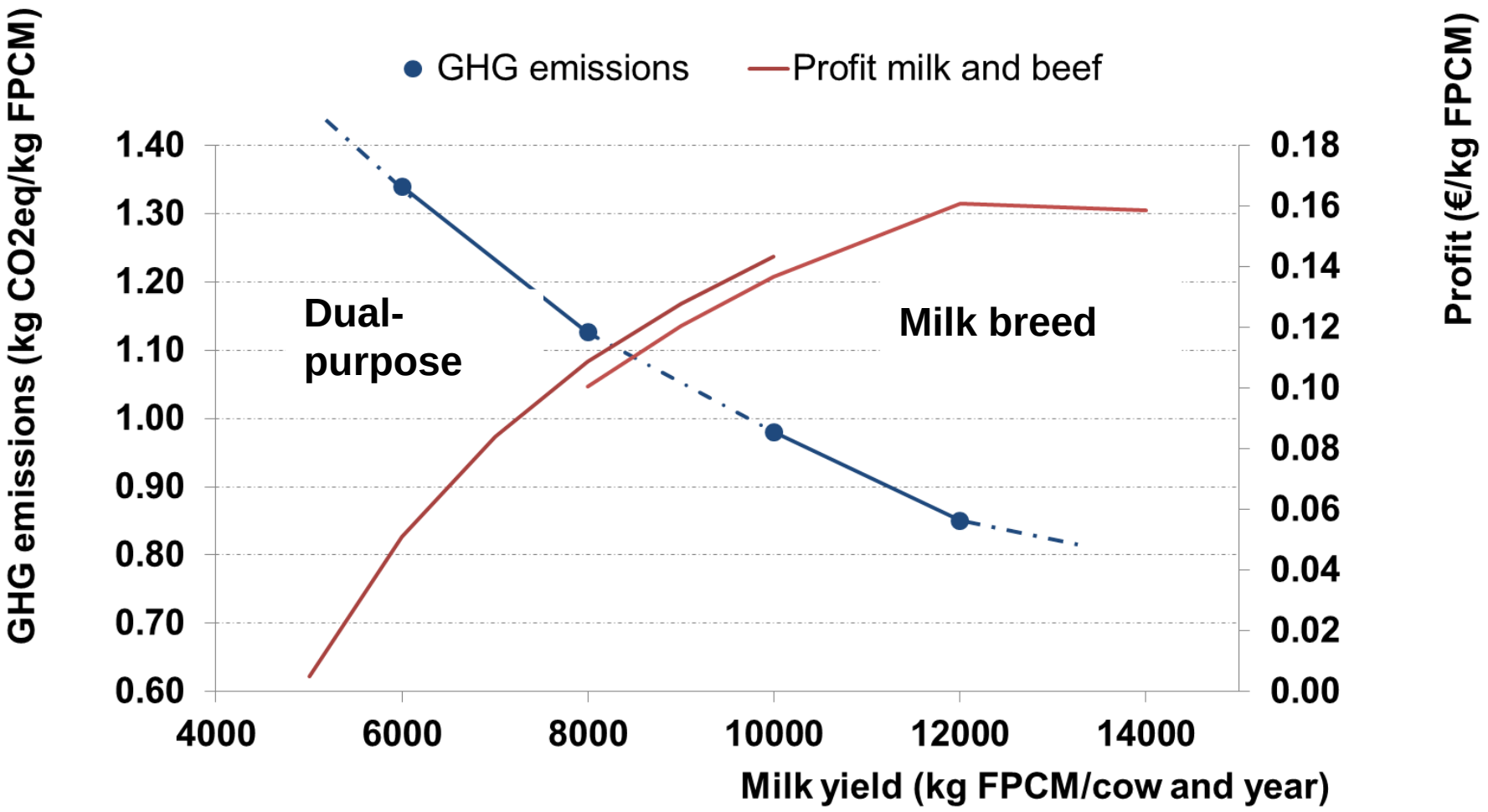
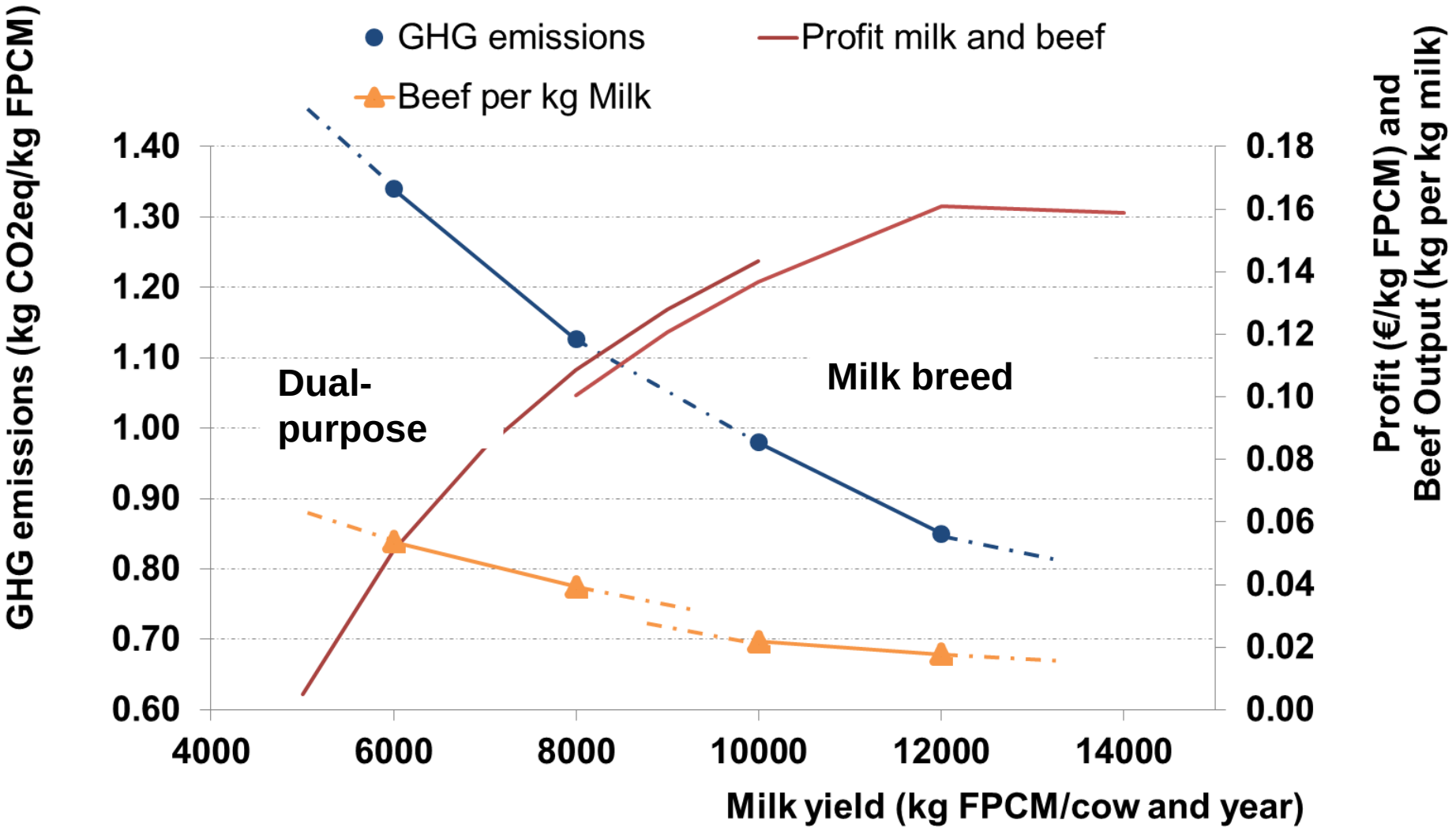
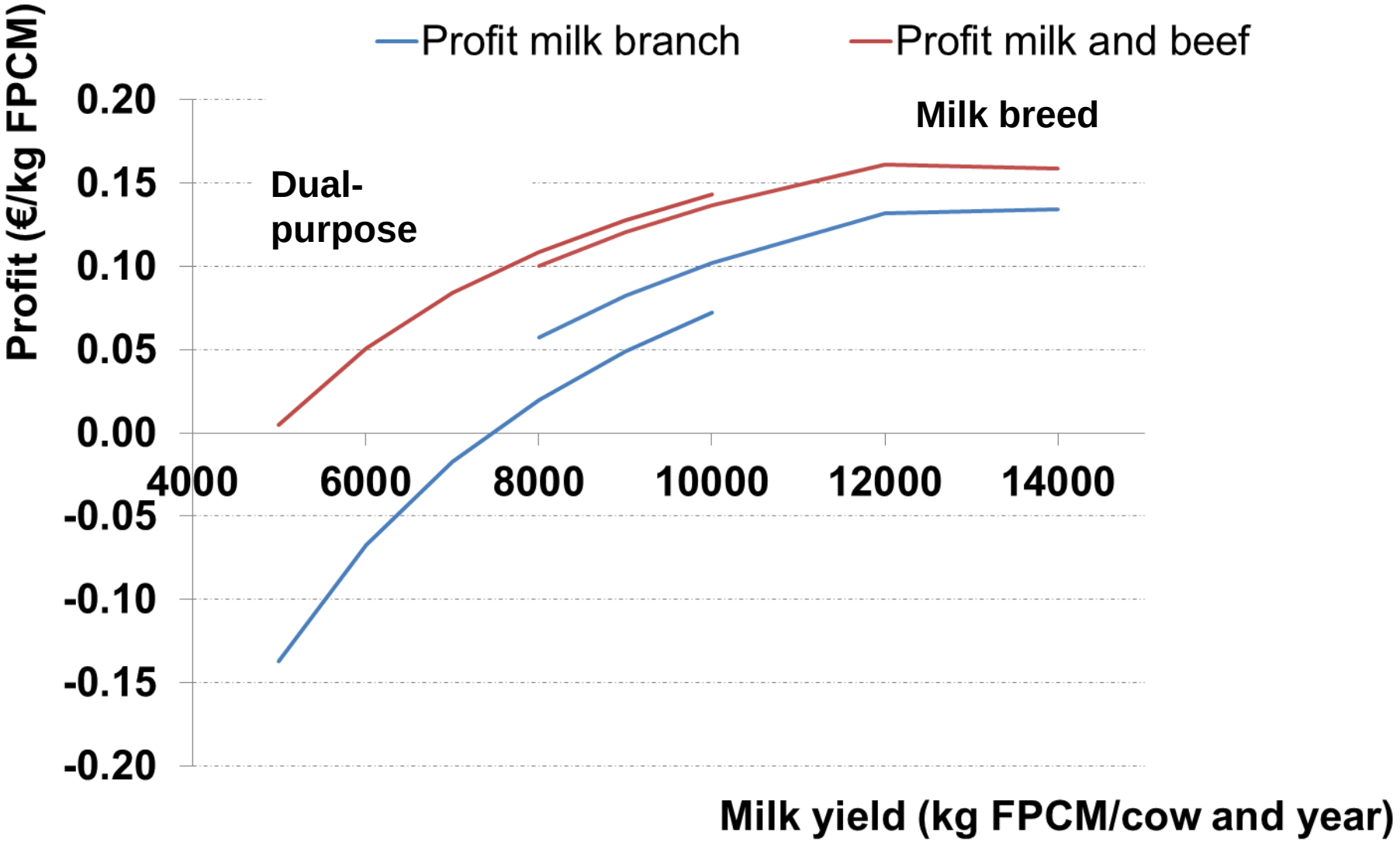
Profit and GHG emissions



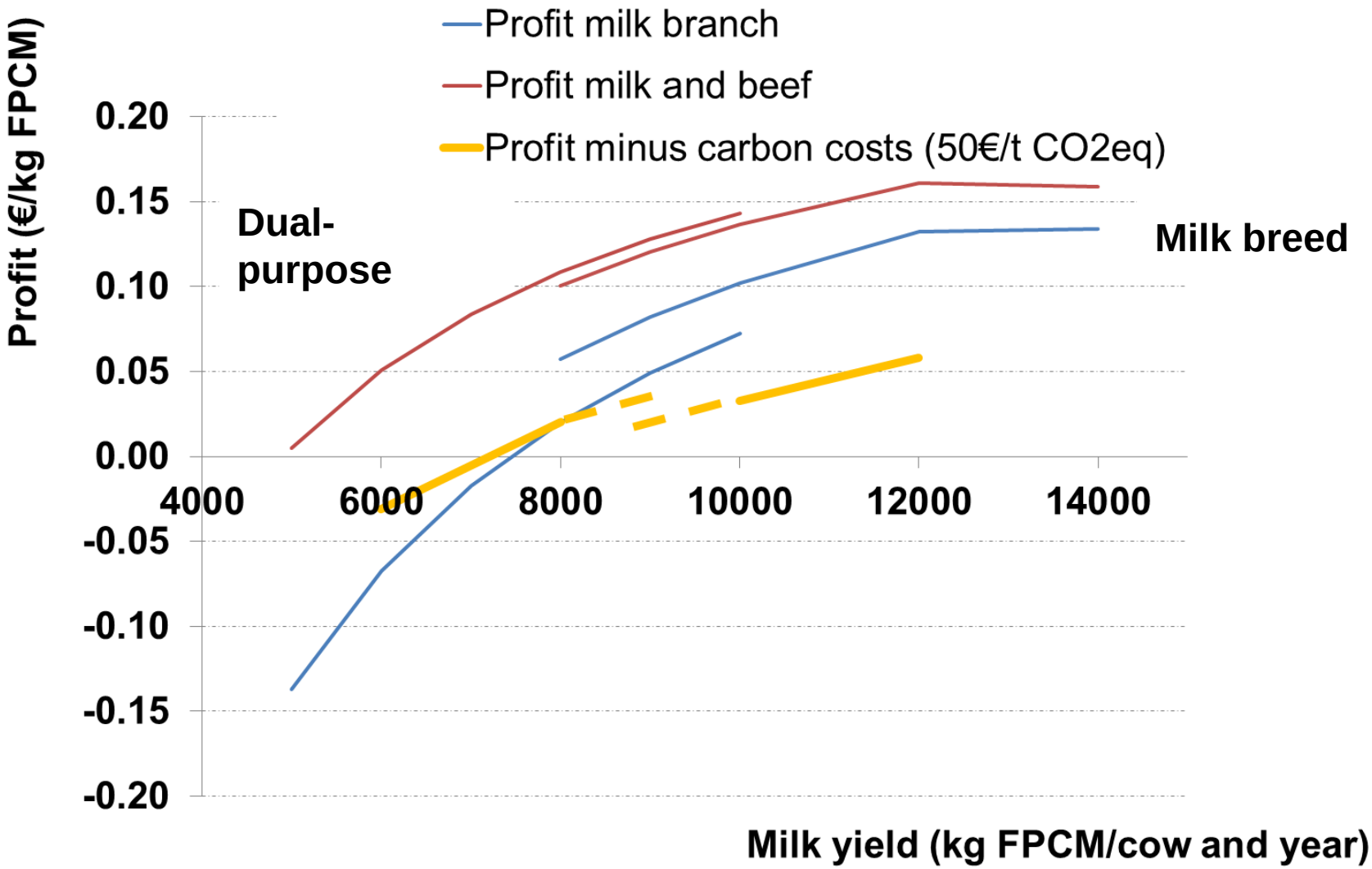
Profit, GHG emissions and beef output



Milk yield and profit



Internalising external costs



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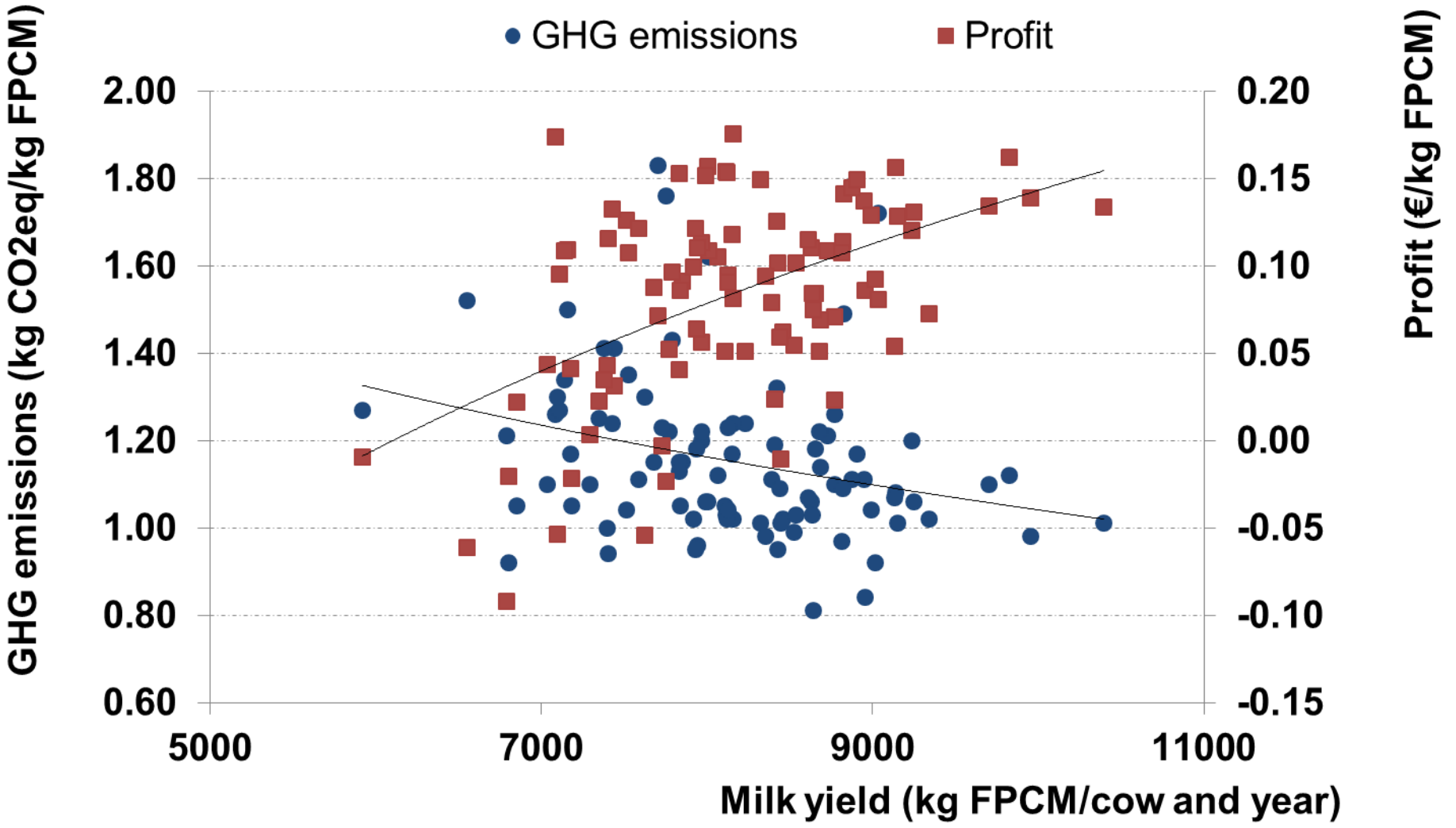
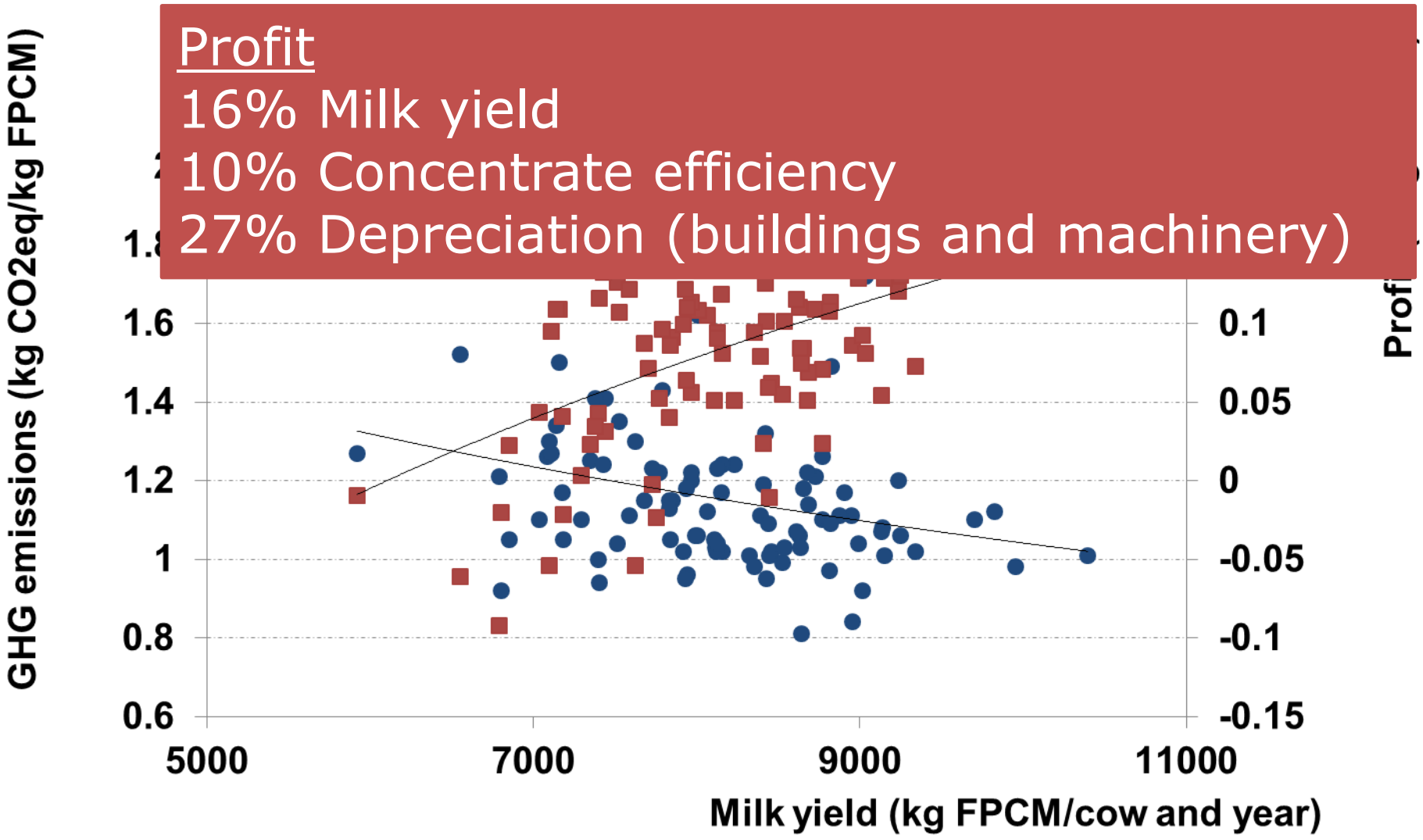
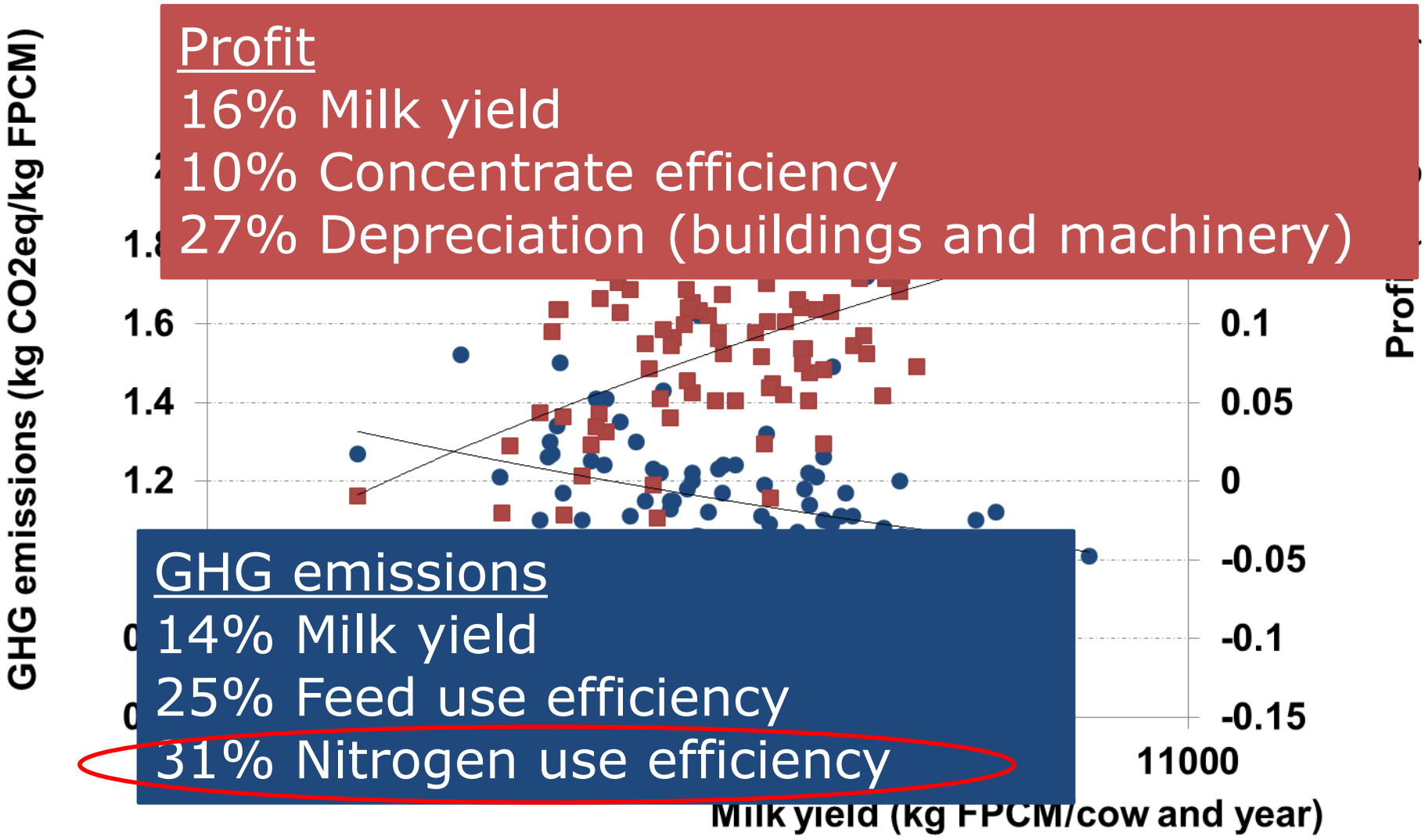
GHG emissions and profit



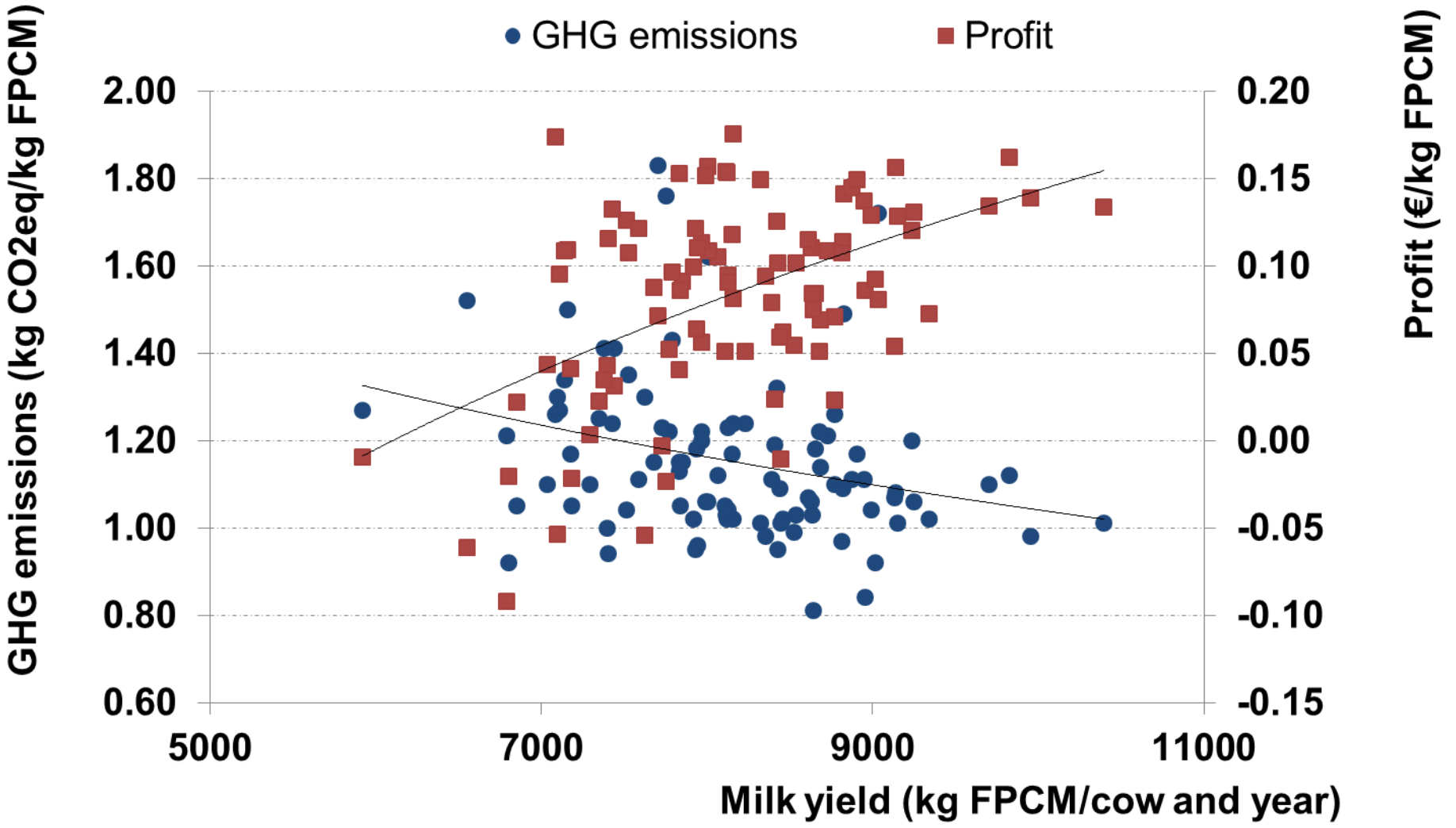
GHG emissions and profit



GHG emissions and profit



GHG emissions and profit



Conclusions

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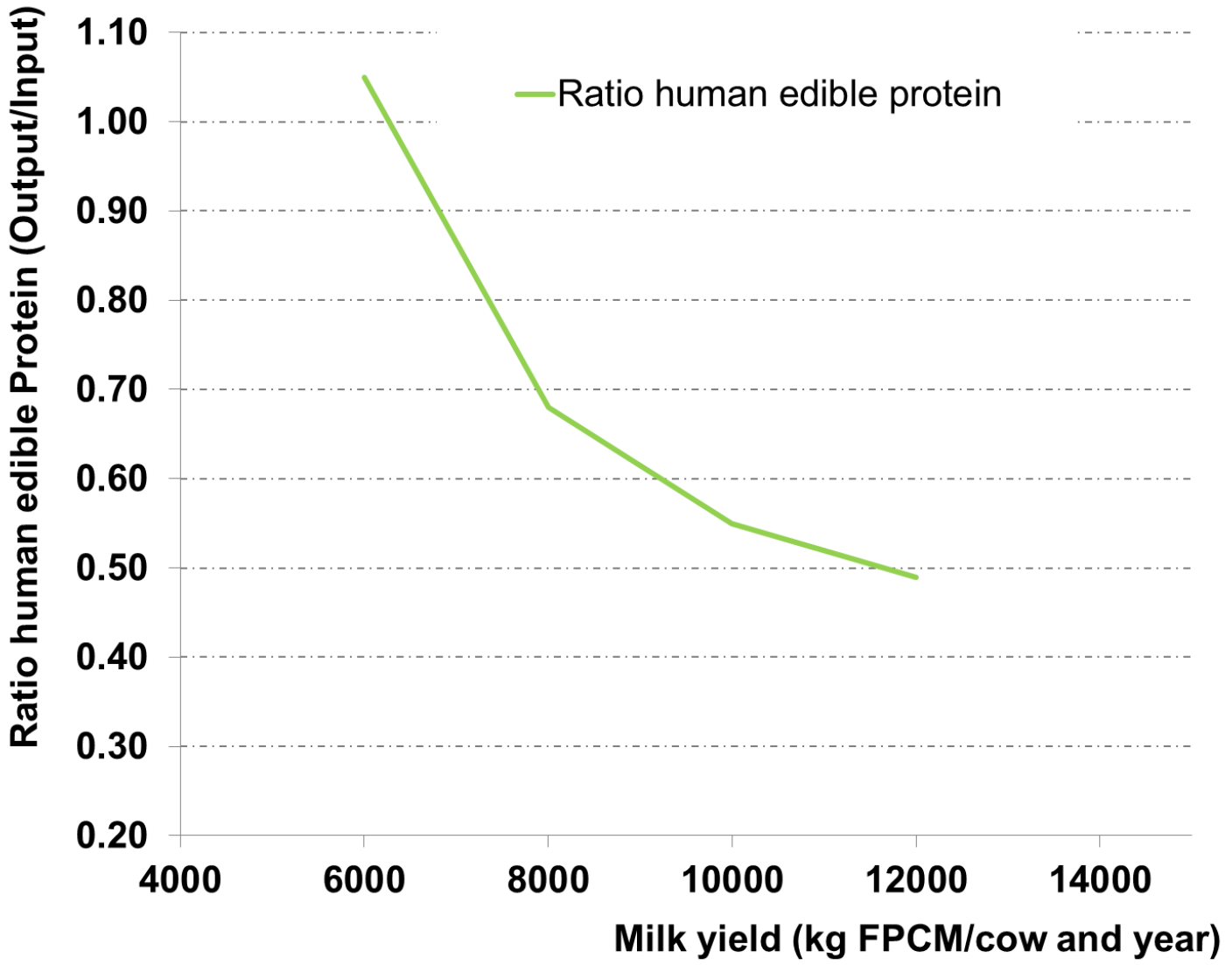
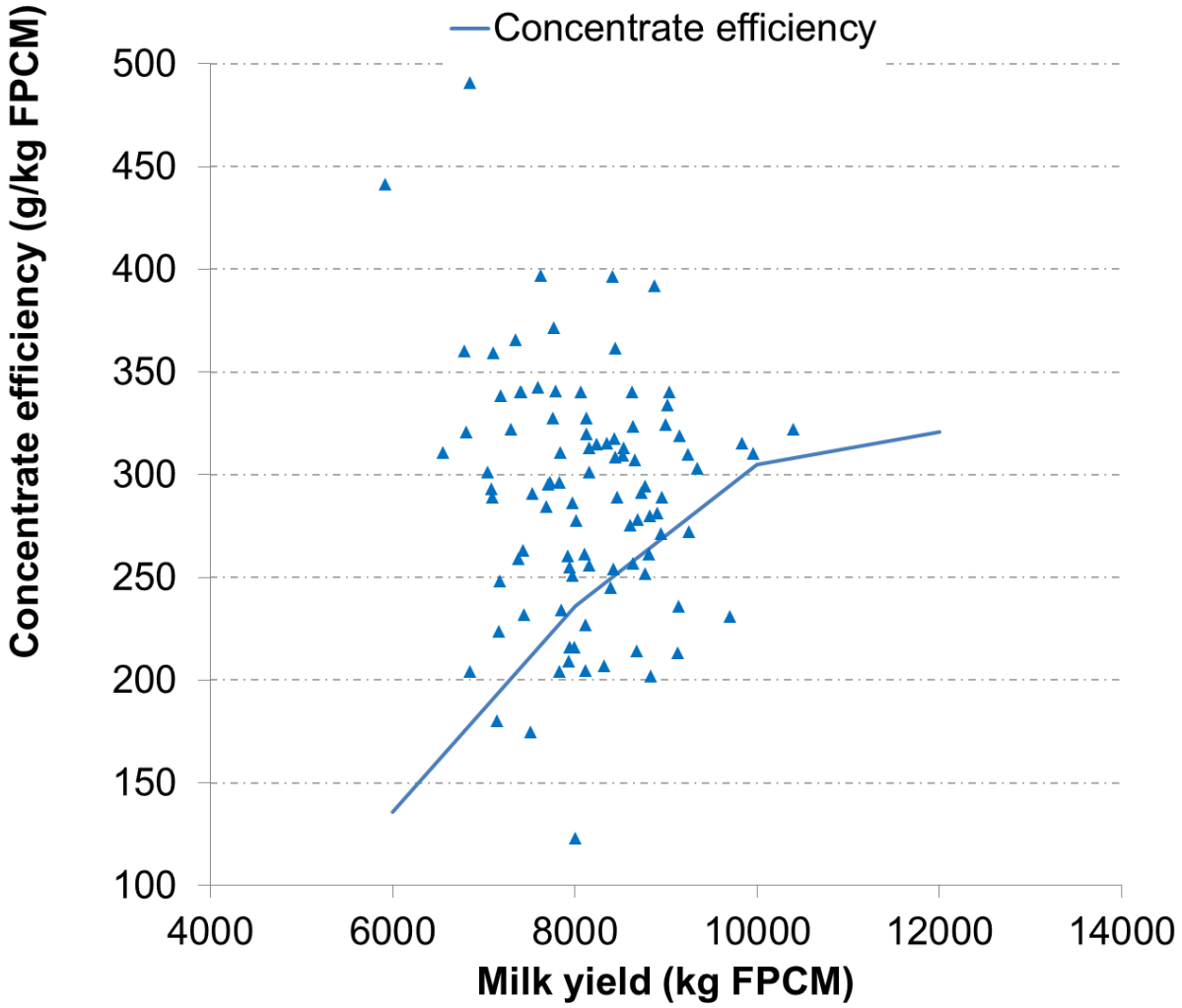
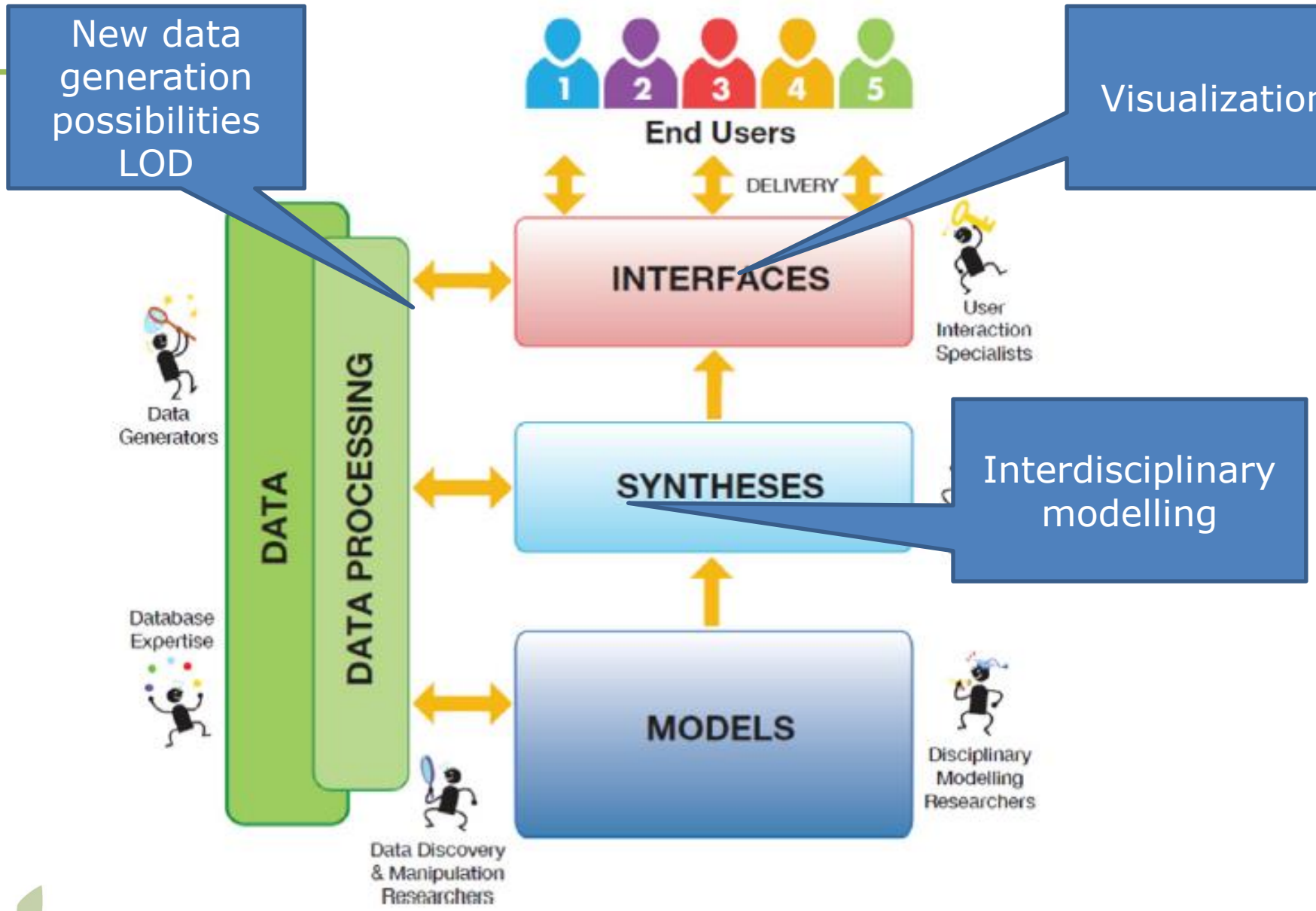
Thank you!

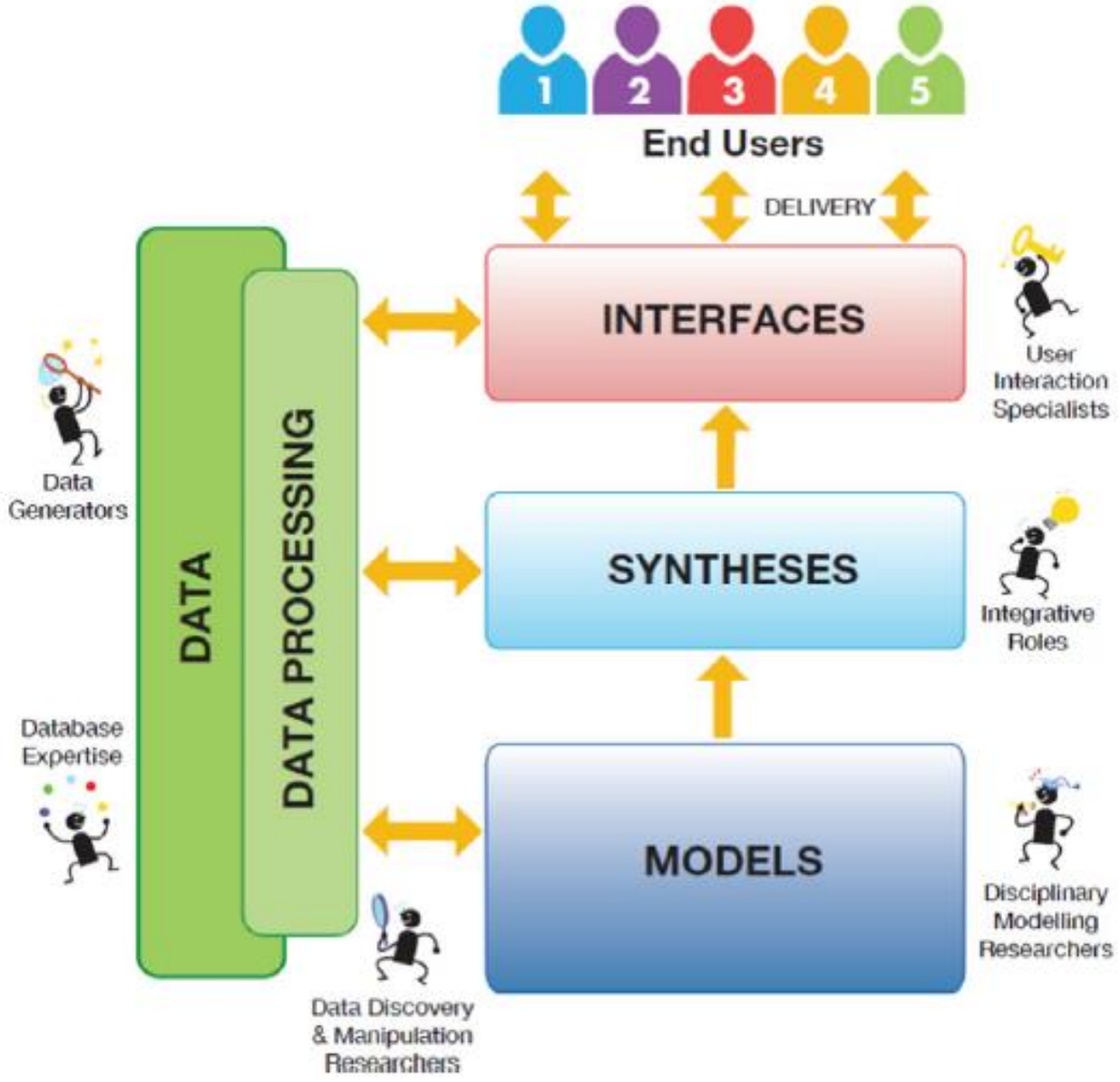
Milk yield, human edible ratio and concentrate efficiency



Milk yield and concentrate efficiency




New data generation possibilities LOD
Visualization
1
2
3
4
5
End Users
DELIVERY
INTERFACES
User Interaction Specialists
Data Generators
DATA
DATA PROCESSING
SYNTHESES
Interdisciplinary modelling
Database Expertise
MODELS
Disciplinary Modelling Researchers
Data Discovery & Manipulation Researchers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1. Gründe für Unterschiede: Models: too simple to depict reality, unrationales Verhalten der Landwirte, management -> damit umgehen
2. Was dagegen tun: Modelle verbessern, Beratung,
3. Zielkonflikt: Situation genau abbilden plus ease of use, suitable for individual farm situation
4. Modellgrenzen, Tendenzen, Möglichkeiten der Verbesserung, ersetzt keine empirische Datenerhebung,

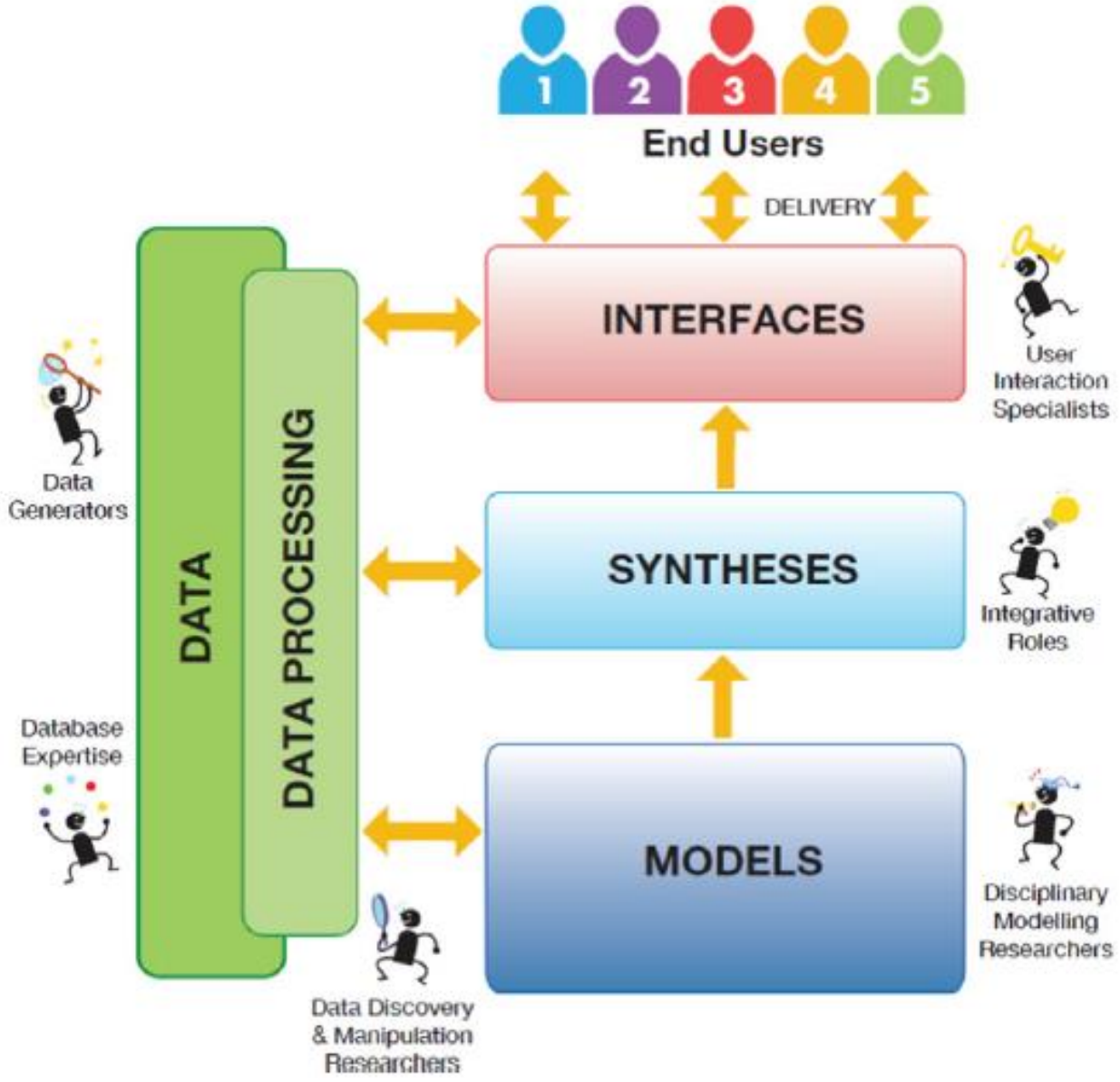
Weiterhin auf empirische Daten setzen und nicht nur auf Tools verlassen!
Soo tiefe Modelle geeignet für Landwirte?
2 Modelle: IDB Plus research

Sinn des tools Verbesserungsmöglichkeiten aufzuzeigen
Punktewolke: relevante veränderbare Einflussgrößen

Fazit

Improve IDB DST -> breiter (partly include external costs), still ease of use (visualization?)

We envision a DSS platform that will connect various models, databases, analysis, and information synthesis tools in an
easy-to-use interface for Sizani to set up the analyses and outputs to answer
questions about the management of that particular farms' biophysical
and socioeconomic situation and the uncertainties in those estimates. Such DSS platforms are possible, but not yet constructed. (Jones et al., 2017)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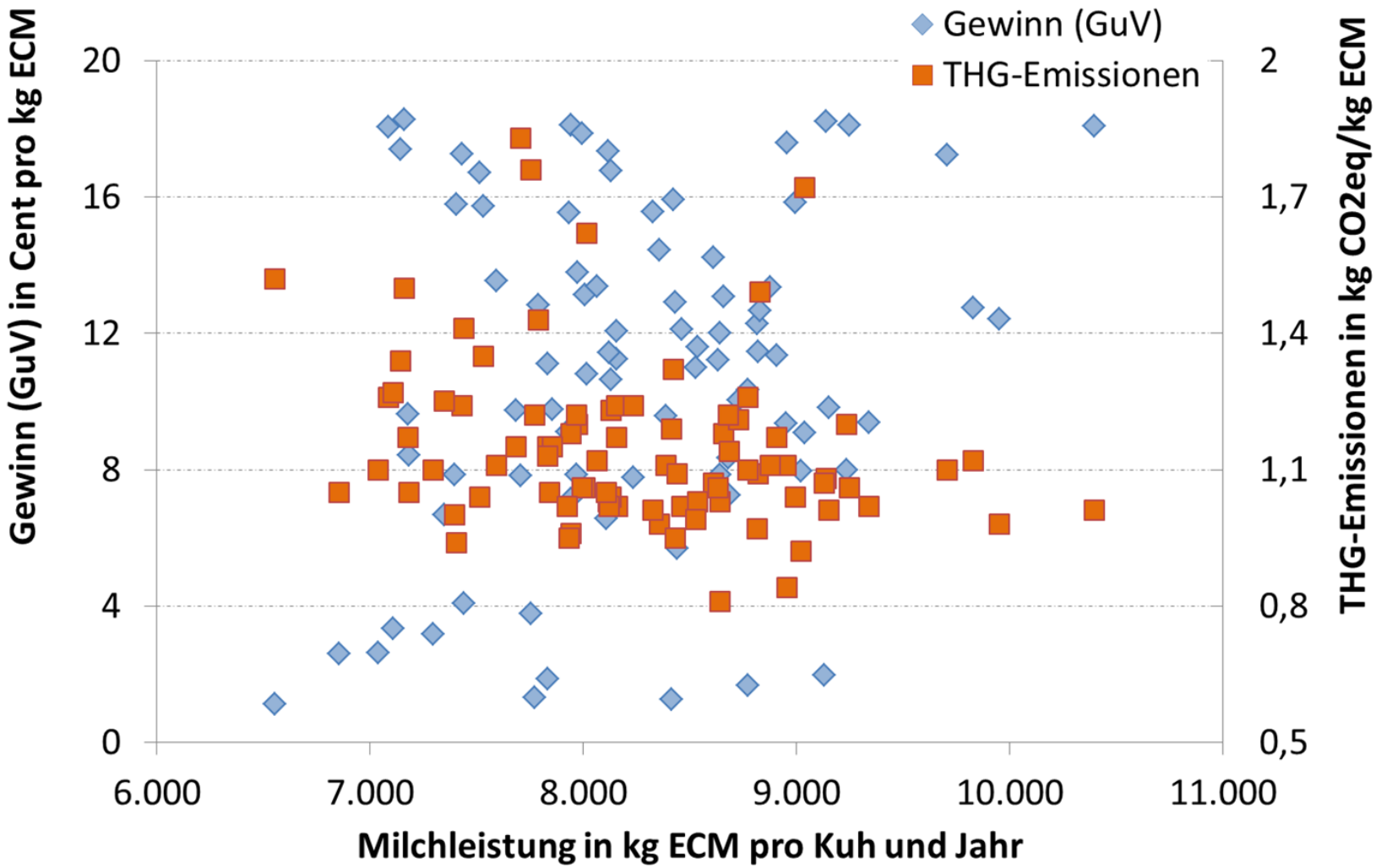
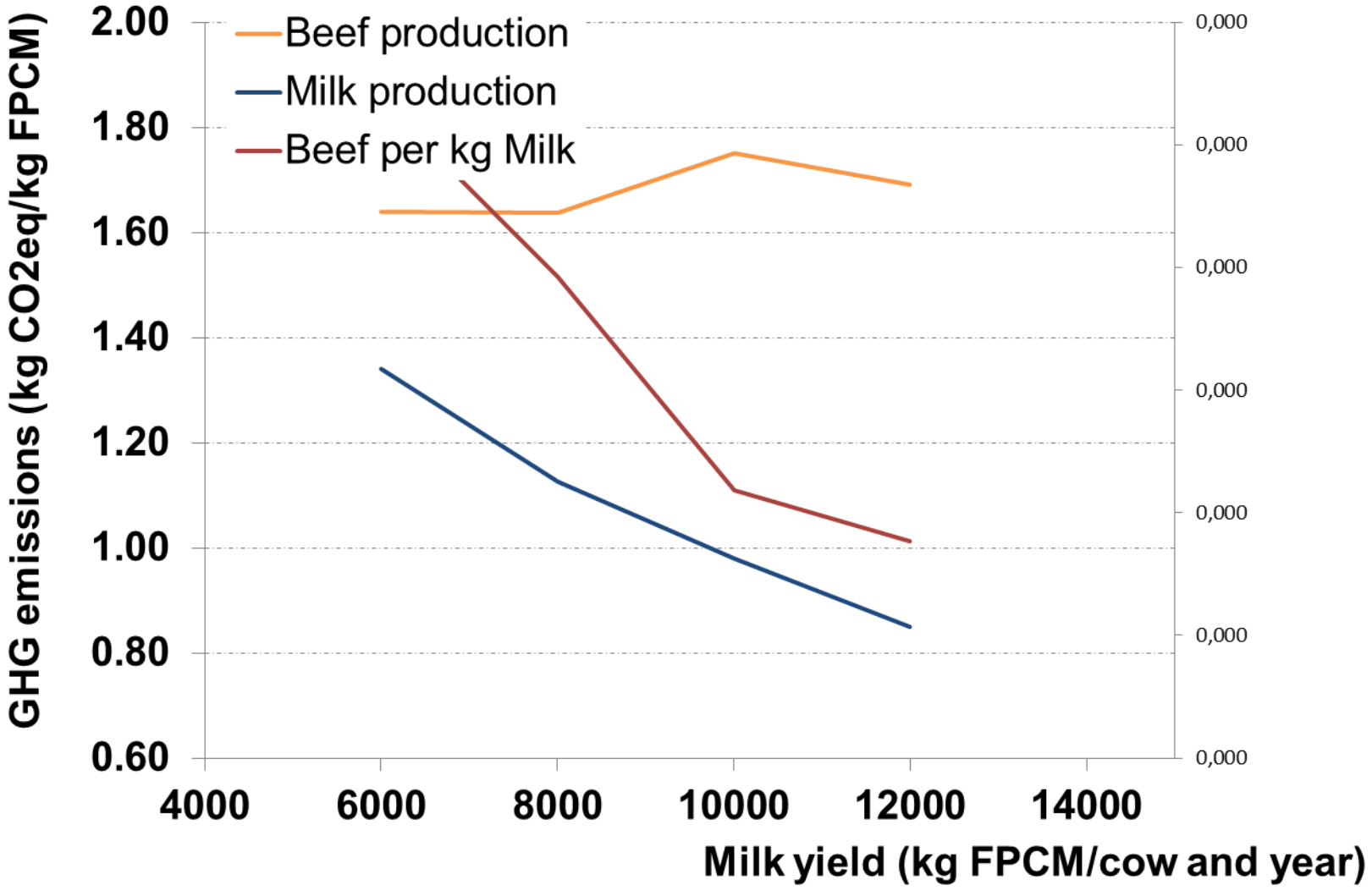
milchleistung	0.146521658
remontierung	0.086873403
gewef	0.144645649
eka	0.008528775
nelnorm	0.254502142
nsaldogew	0.310865815
hauptfutterflaechejekuh	0.012193375
grobfutterleistung	0.023840818
kraftfutter	**0.006110611**
kaelberverlustegesamt	**0.005917754**

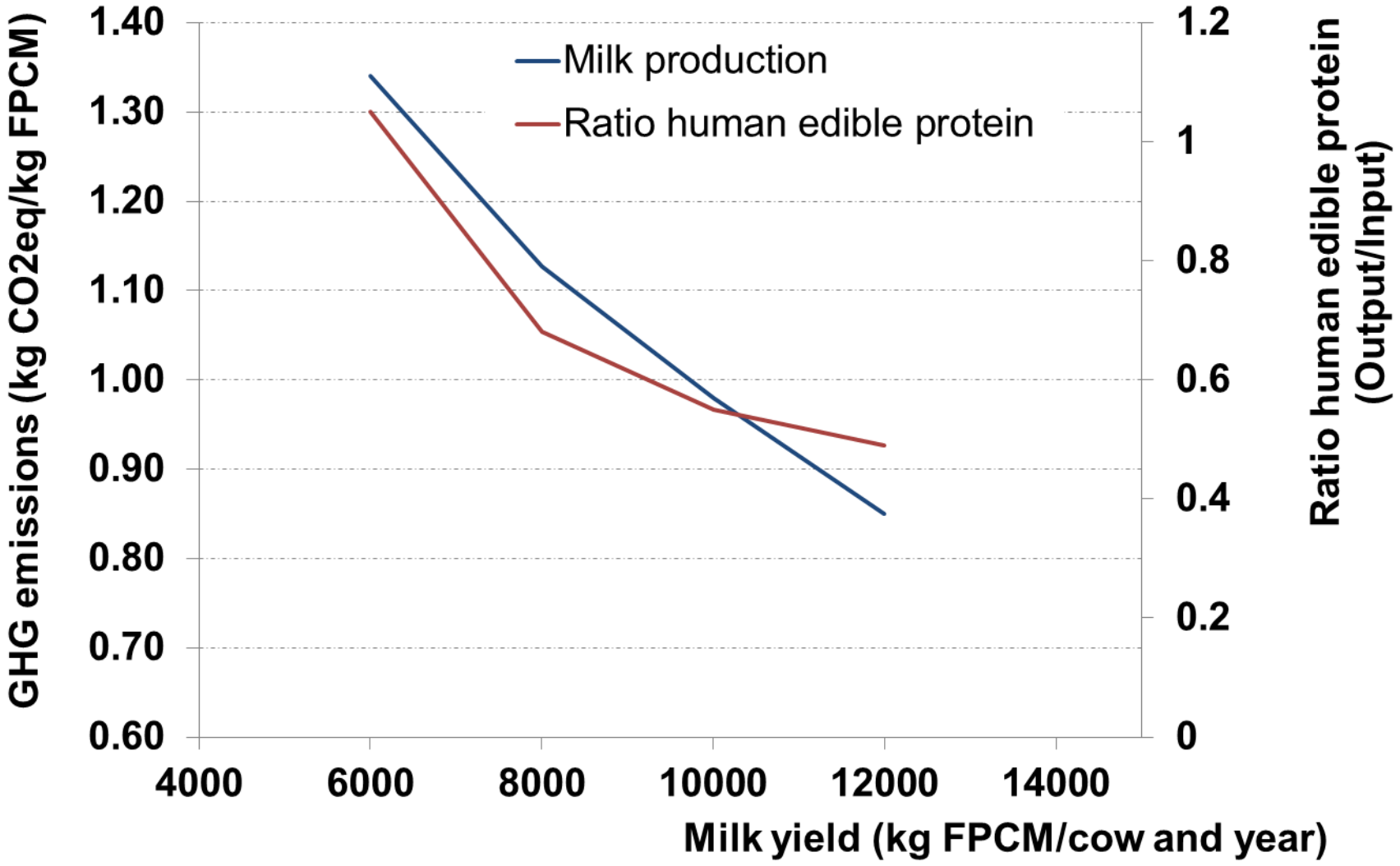
Gewinn nach Abzug Pachtansatz und Lohnansatz

Akh pro Kuh als erklärende

milchleistungecm	0.169317773
remontierung	0.009263281
nelnorm	0.035235331
hauptfutterflaechejekuh	0.109618152
kraftfutter	0.104039733
kaelberverlustegesamt	0.022661016
zzgsprodkos	0.022591302
zzmsprodkos	0.010275578
abschreibunggebaeudekuh	0.179544319
abschreibungmaschinenkuh	0.100846608
akhprokuh	**0.23660690**

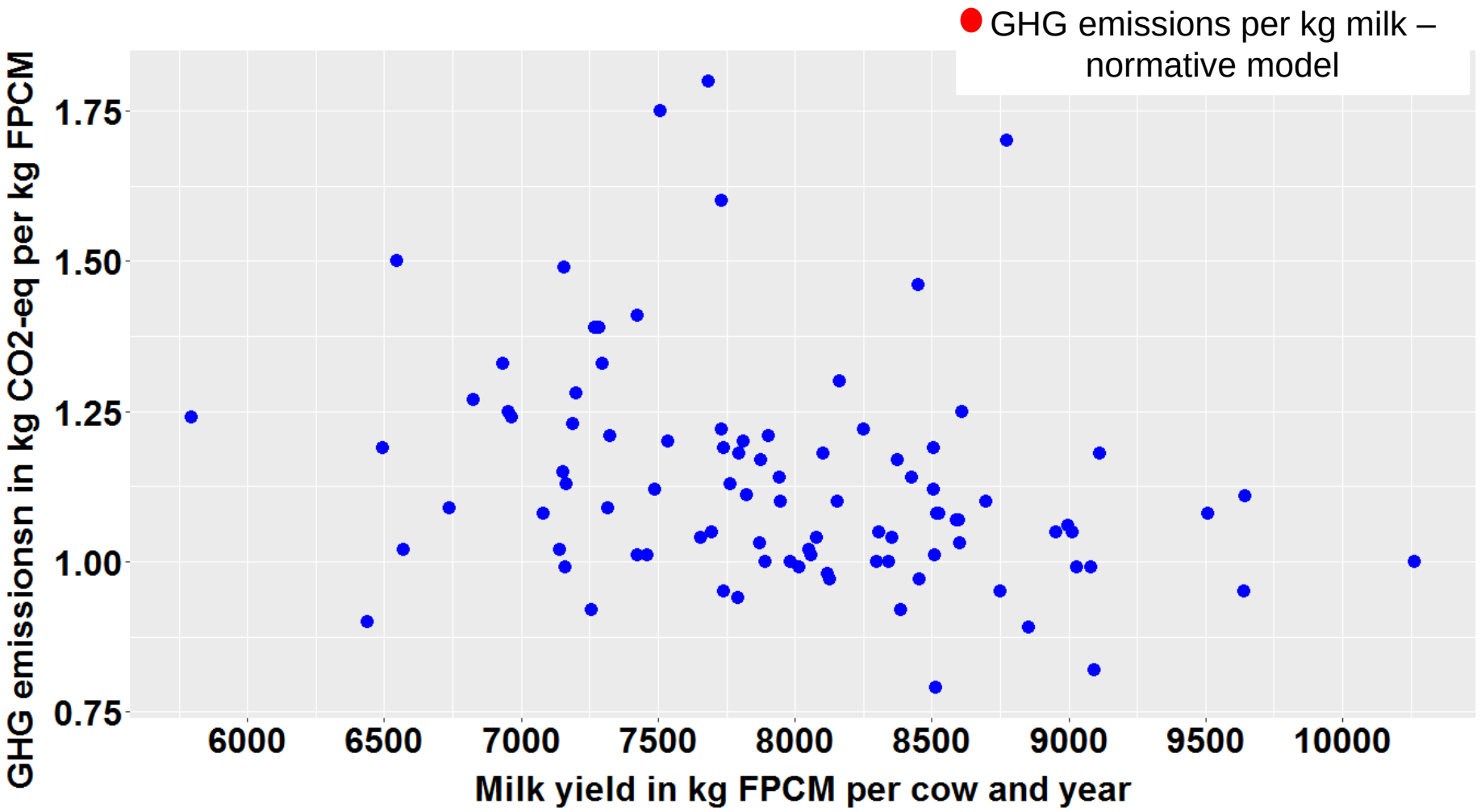

Gewinn (GuV)
THG-Emissionen
Gewinn (GuV) in Cent pro kg ECM
THG-Emissionen in kg CO2eq/kg ECM
20
16
12
8
4
0
2
1,7
1,4
1,1
0,8
0,5
6.000
7.000
8.000
9.000
10.000
11.000
Milchleistung in kg ECM pro Kuh und Jahr


Beef production
Milk production
Beef per kg Milk
GHG emissions (kg CO2eq/kg FPCM)
2.00
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0,000
0,000
0,000
0,000
0,000
0,000
0,000
4000
6000
8000
10000
12000
14000
Milk yield (kg FPCM/cow and year)


GHG emissions (kg CO2eq/kg FPCM)
1.40
1.30
1.20
1.10
1.00
0.90
0.80
0.70
0.60
Milk production
Ratio human edible protein
1.2
1
0.8
0.6
0.4
0.2
0
Ratio human edible protein (Output/Input)
4000
6000
8000
10000
12000
14000
Milk yield (kg FPCM/cow and year)

Stickstoff und BZA Daten

GHG emissions with different milk yield per cow: model versus practical farms



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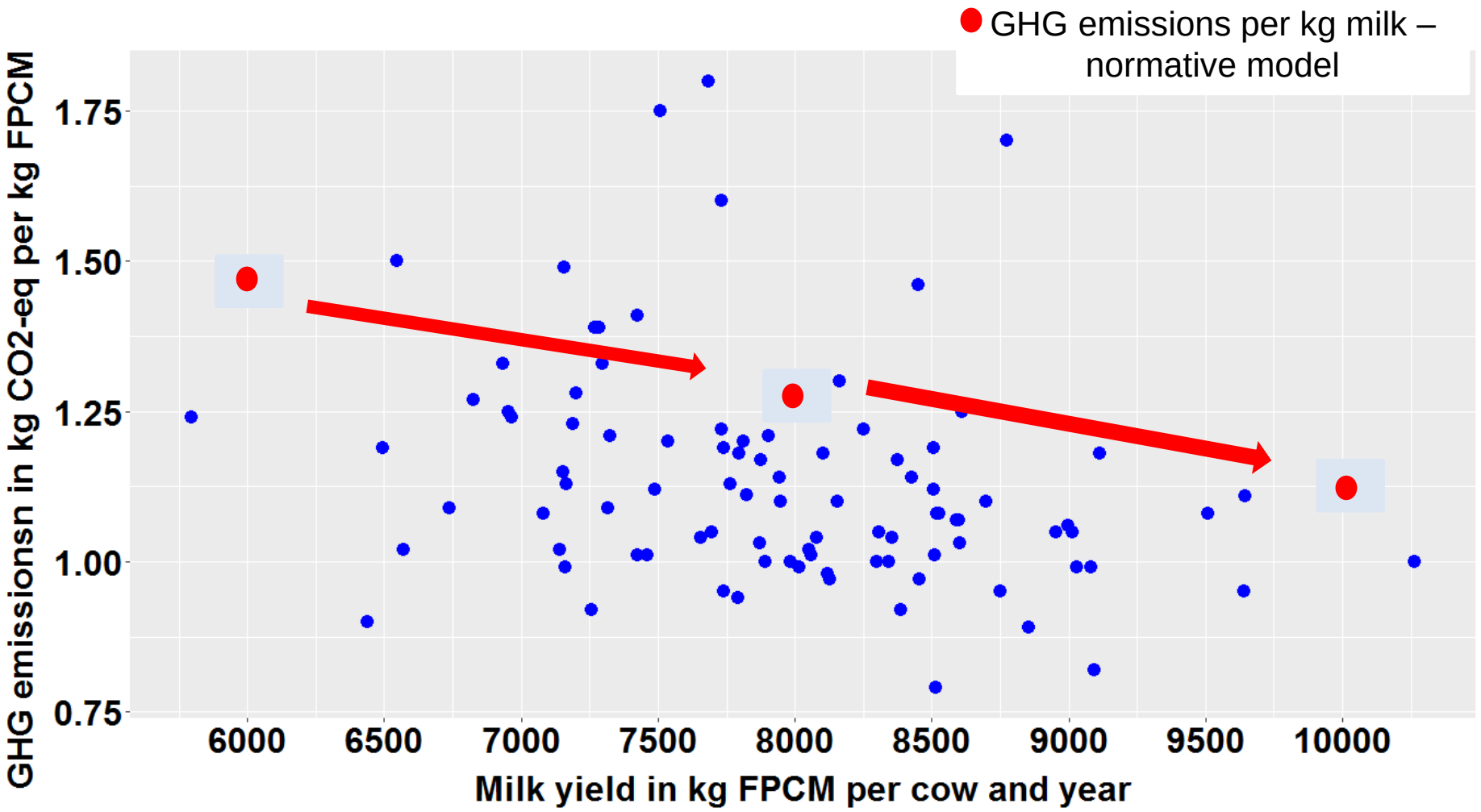
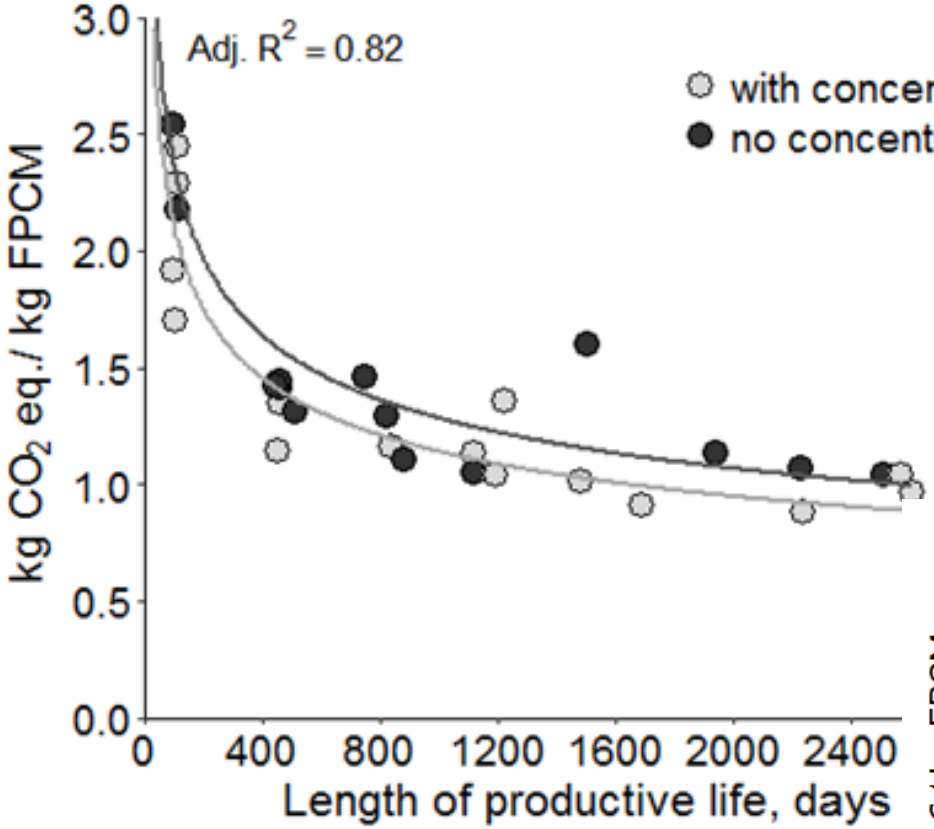
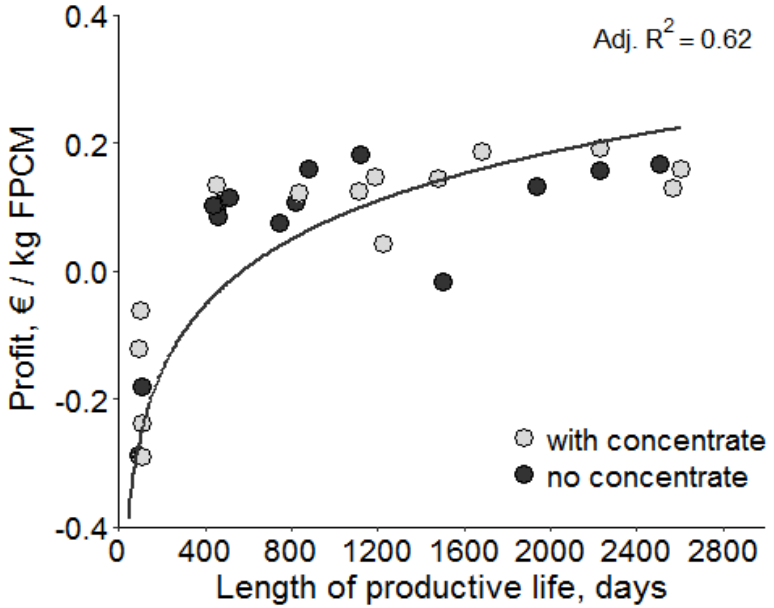
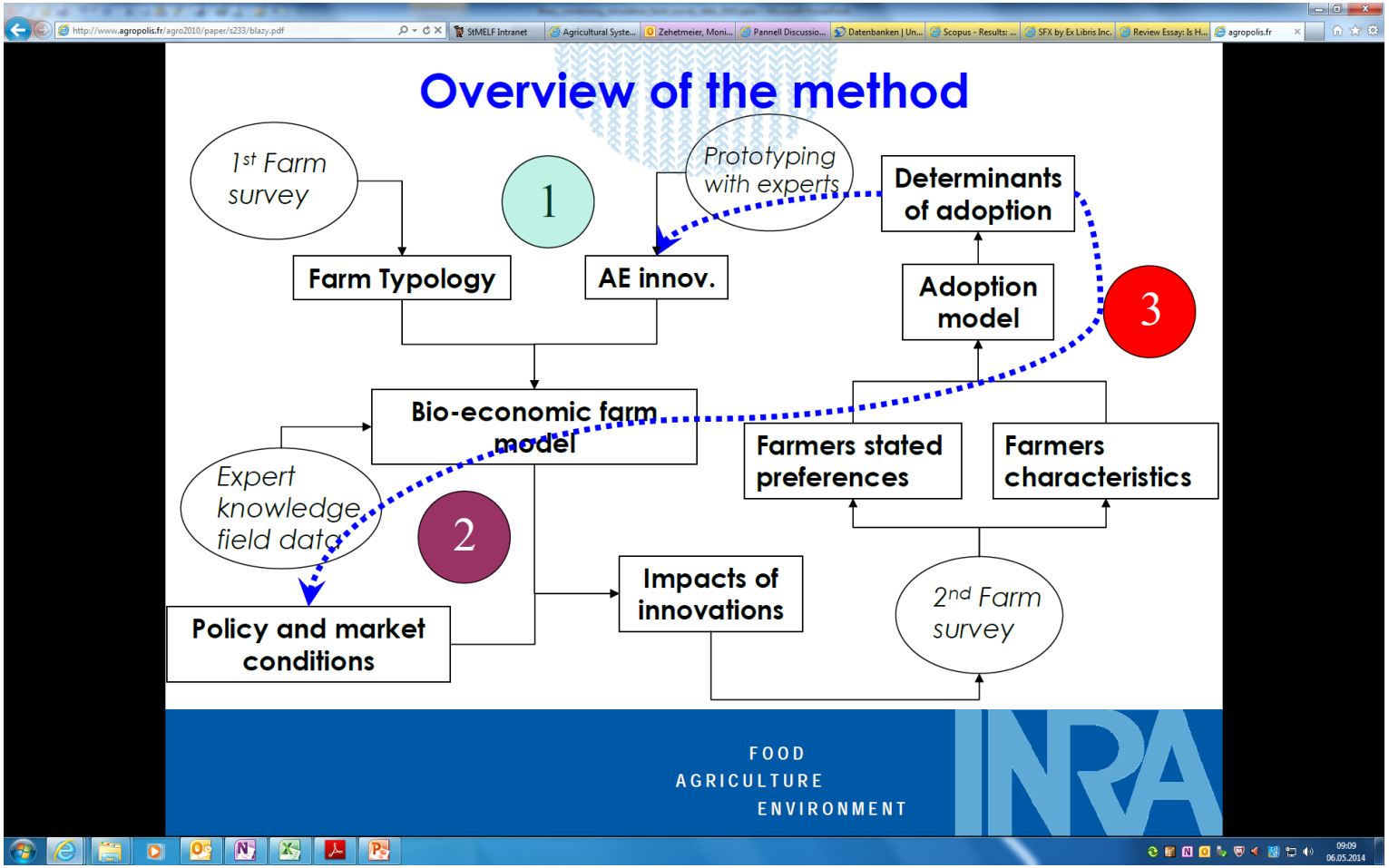


Internalisierung der externen THG Kosten
- THG bewerten

2. Teil: wie spiegeln Modelle die Realität wider


Adj. $R^2 = 0.82$
with concentrate
no concentrate
kg CO_2 eq./ kg FPCM
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
400
800
1200
1600
2000
2400
Length of productive life, days


Adj. $R^2 = 0.62$
Profit, € / kg FPCM
0.4
0.2
0.0
-0.2
-0.4
with concentrate
no concentrate
0
400
800
1200
1600
2000
2400
2800
Length of productive life, days


Overview of the method
1st Farm survey
1
Prototyping with experts
Determinants of adoption
Farm Typology
AE innov.
Adoption model
3
Bio-economic farm model
Farmers stated preferences
Farmers characteristics
Expert knowledge field data
2
Impacts of innovations
2nd Farm survey
Policy and market conditions
FOOD
AGRICULTURE
ENVIRONMENT
INRA

- DST -> Ease of use, visual presentation of decision-making information (Rose et al., 2016)
- Economists face the challenge of more effectively comunicating the results of their research beyond the pages of academic journals (Pannell et al., 2017)

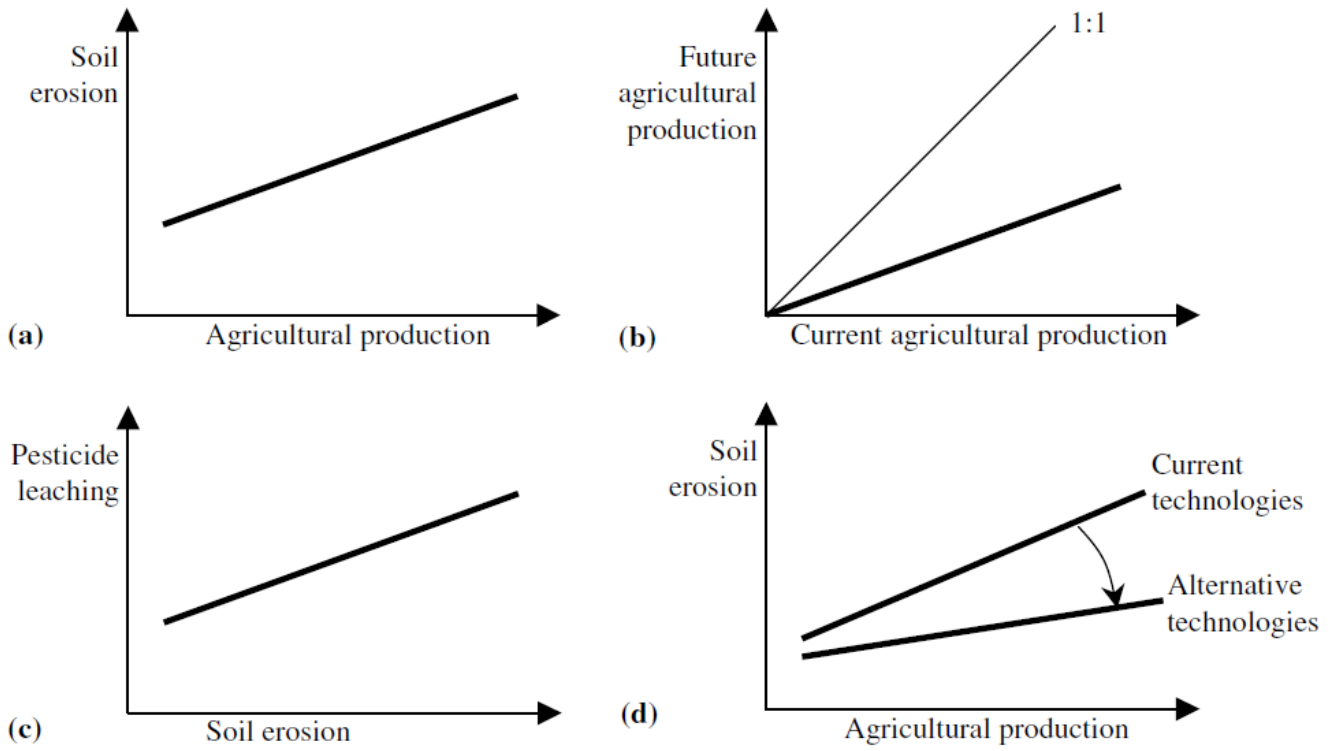


Fig. 2. Examples of possible tradeoff curves. (a) Increased soil erosion when intensifying agricultural systems. (b) The negative effects on future productivity as a result of soil erosion when intensifying current agricultural production. (c) Increased pesticide leaching as a result of increased erosion rates. (d) The impact of alternative (conservation) technologies on the tradeoff curve.

- Flat earth economics

- New insights into efficiency

  – Traditional insight for farmers/policy makers into efficiency

Hinweise zur Bedienung ++ alle Detail-Infos einblenden -- alle ausblenden

- Mit Hilfe der Schaltflächen ⊞ und ⊟ können Sie zum jeweiligen Thema weitere Info ein- bzw. ausblenden.
- Die Eingabefelder sind mit bayerischen Durchschnittswerten vorbelegt. Diese Werte können Sie mit betriebseigenen Daten überschreiben.
- Unten stehende Zahlenwerte können zur besseren Vergleichbarkeit verschiedener Verfahren oder unterschiedlicher Szenarien eines Verfahrens auf eine gemeinsame Vergleichsseite übertragen werden. Diese Daten stehen Ihnen bis zum Verlassen der Anwendung "Deckungsbeiträge und Kalkulationsdaten" zur Verfügung. **Bitte beachten Sie aber: Bei Arbeitspausen über einer Stunde gehen die bisher gespeicherten Daten verloren!**
- Detailinformationen zu den jeweiligen Punkten erhalten Sie, wenn Sie mit der Maus über das Fragezeichen-Symbol fahren.

⊞ Grundlegende Angaben zum Produktionsverfahren

Kommentar: 5000

Anzeige der Leistung-/Kostenpositionen
(•) inkl. MwSt. = Einstellung für pauschalierende Betriebe
( ) ohne MwSt. = Einstellung für optierende Betriebe

Betrachtungszeitraum: 12 Monate

⊞ Kennwerte des Produktionsverfahrens

Rasse: Fleckvieh

Abgangsquote: 30.0 % Zwischenkalbezeit: 393.0 Tage

Bestandsergänzung über: Erstkalbungen im eigenen Bestand: 0.0 % Zukauf von Jungkühen: 100.0 %

Kälberverlustquote: 7.3 % Kälber je Kuh und Jahr: 0.86

Milchmenge und Preisansätze

⊞ verkaufte Milch	kg/Kuh u. Jahr	4952
⊞ Milchpreis (inkl. 10.7 % MwSt.)	ct/kg	41.67
⊞ Milcherlös (inkl. 10.7 % MwSt.)	€/Kuh u. Jahr	2063.5
⊞ Kälbererlös (inkl. 10.7 % MwSt.)	€/Kuh u. Jahr	358.3
⊞ Altkuherlös (inkl. 10.7 % MwSt.)	€/Kuh u. Jahr	352.7

Deckungsbeitragsberechnung je Kuh und Jahr

3.1.1.3. Decision support tools. Most existing DSS tools that are available in Apps are focused on relatively narrow issues (e.g., see www.agroclimate.org), such as when to apply a fungicide to a particular crop, when to apply the next irrigation, or how much N fertilizer to apply to a particular crop that will be grown on a particular type of soil in a specific setting. There are few DSS tools that make use of more integrated models to help advisors advise farmers in making farming system decisions (but see Keating et al., 1991, Keating and McCown, 2001). We envision a DSS platform that will connect various models, databases, analysis, and information synthesis tools in an easy-to-use interface for Sizani to set up the analyses and outputs to answer questions about the management of that particular farms' biophysical and socioeconomic situation and the uncertainties in those estimates. Such DSS platforms are possible, but not yet constructed.

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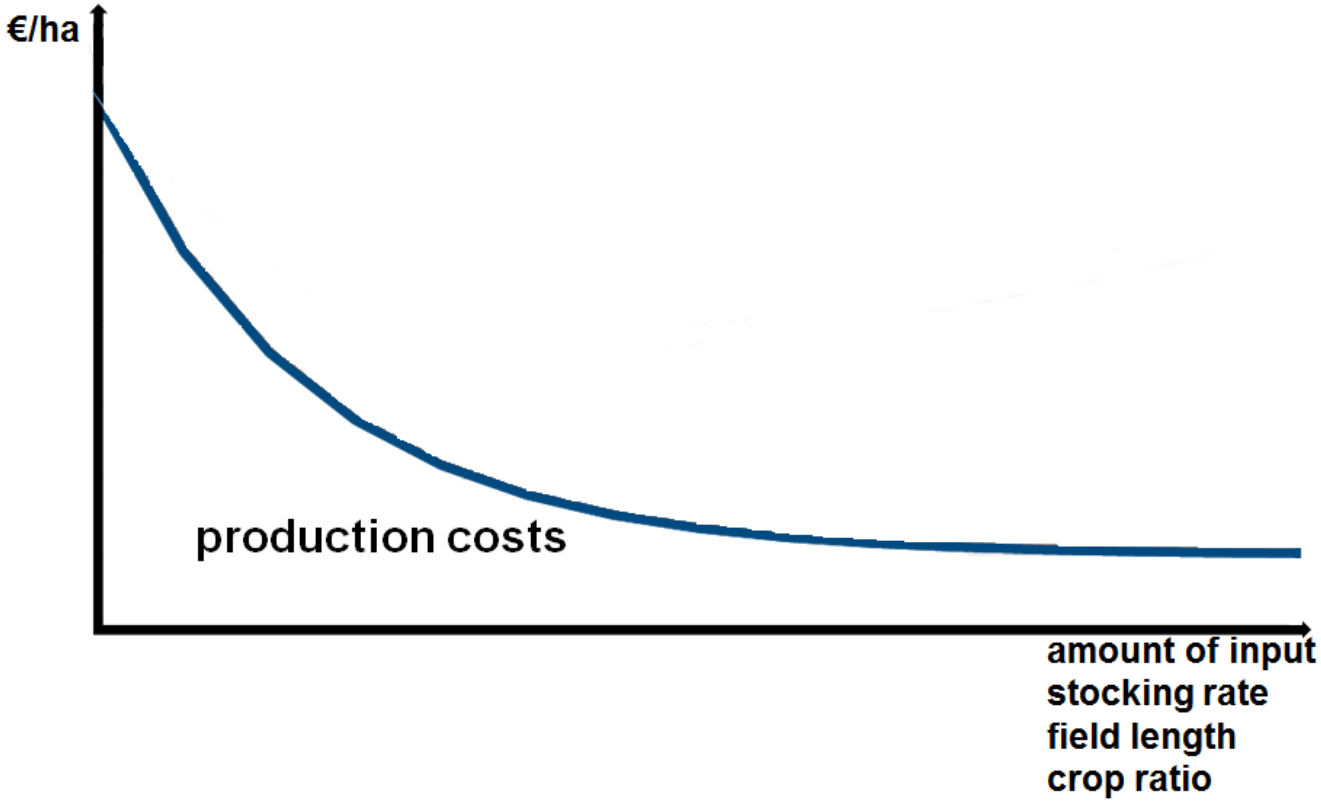
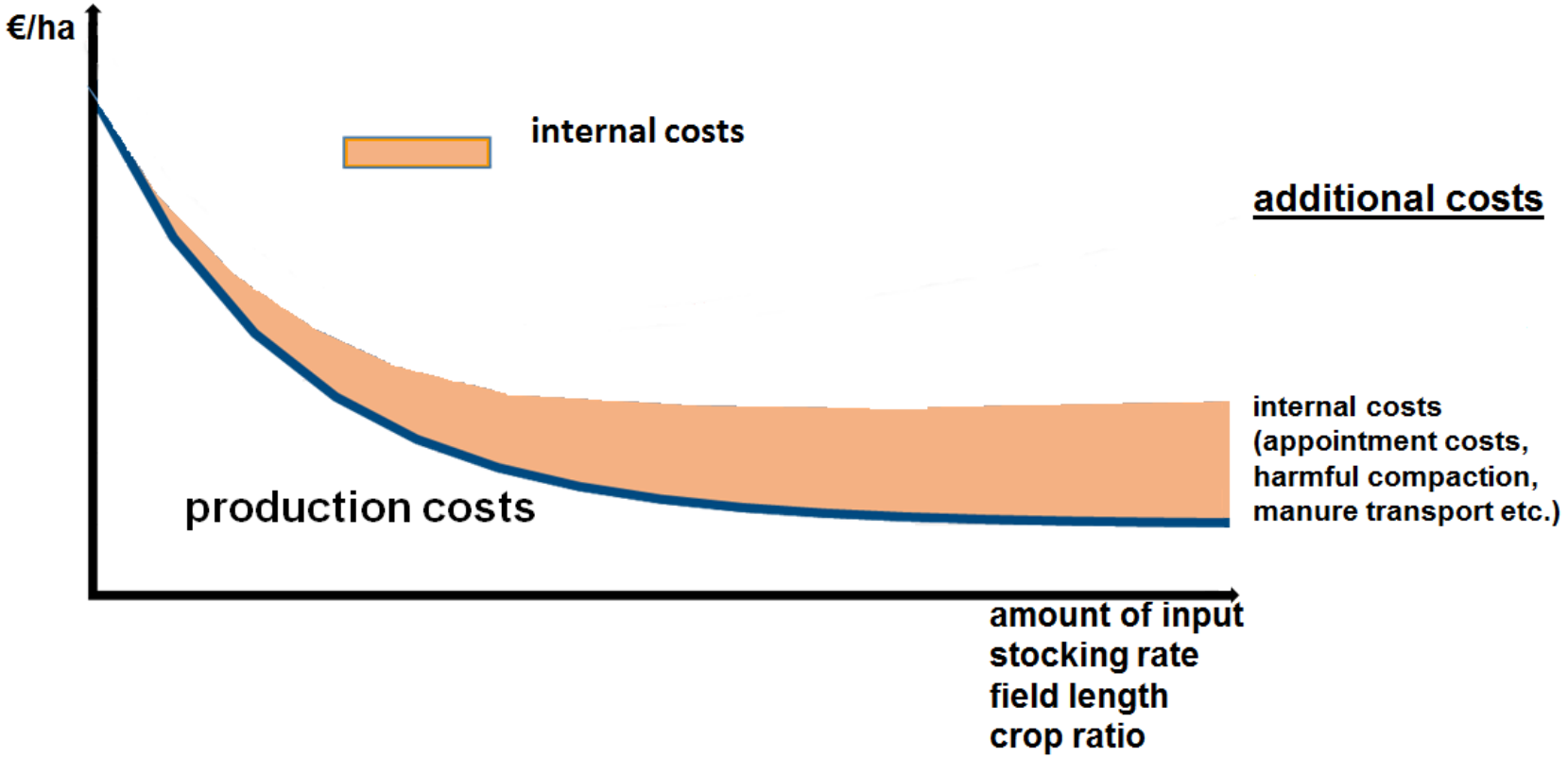
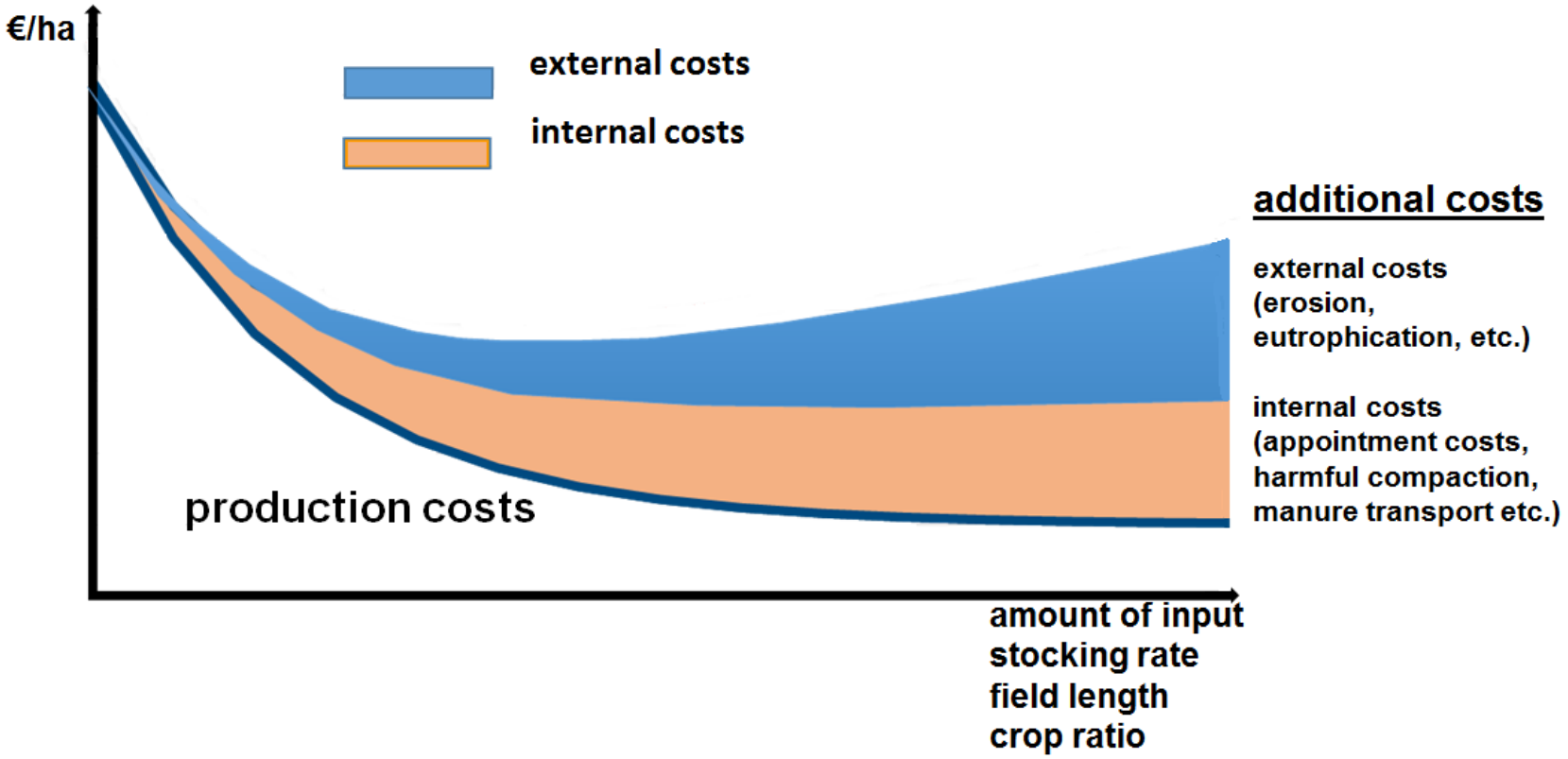
Production costs and additional costs



Production costs and additional costs



Production costs and additional costs



Production costs and additional costs