



Selection for Lower Methane Livestock

Selection Index Considerations

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Selection for lower methane livestock

What is needed?

- **Phenotypes:** building a reference population so we can use genomic prediction
- **Genetic Parameters** with other important traits - Including Feed Intake
- **A selection strategy**
 - Define a breeding objective
 - Define a selection index
 - Communication with breeder, producers, other stakeholders

The problem

We have now EBVs for methane, what do we do with them?

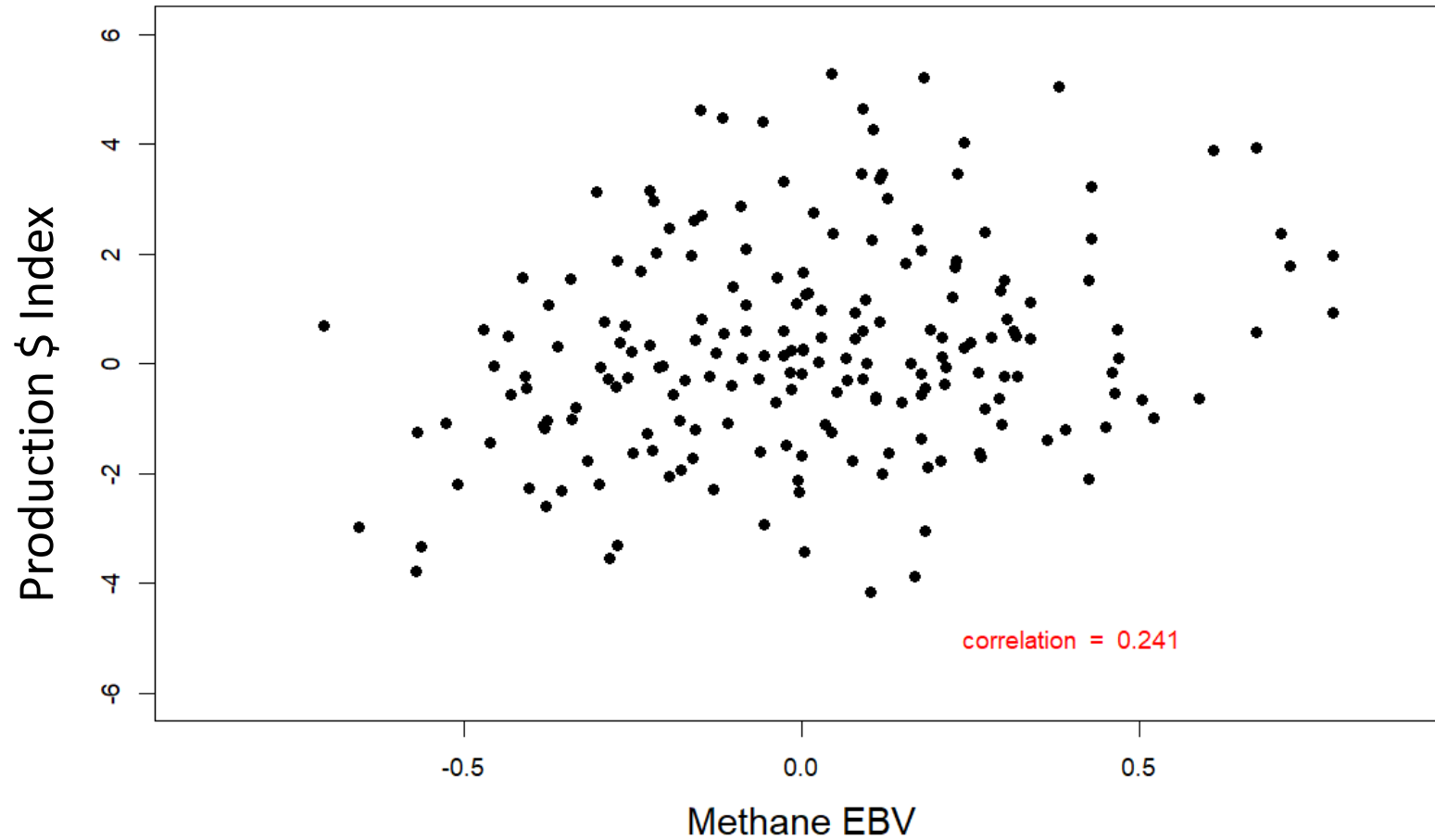
The research question



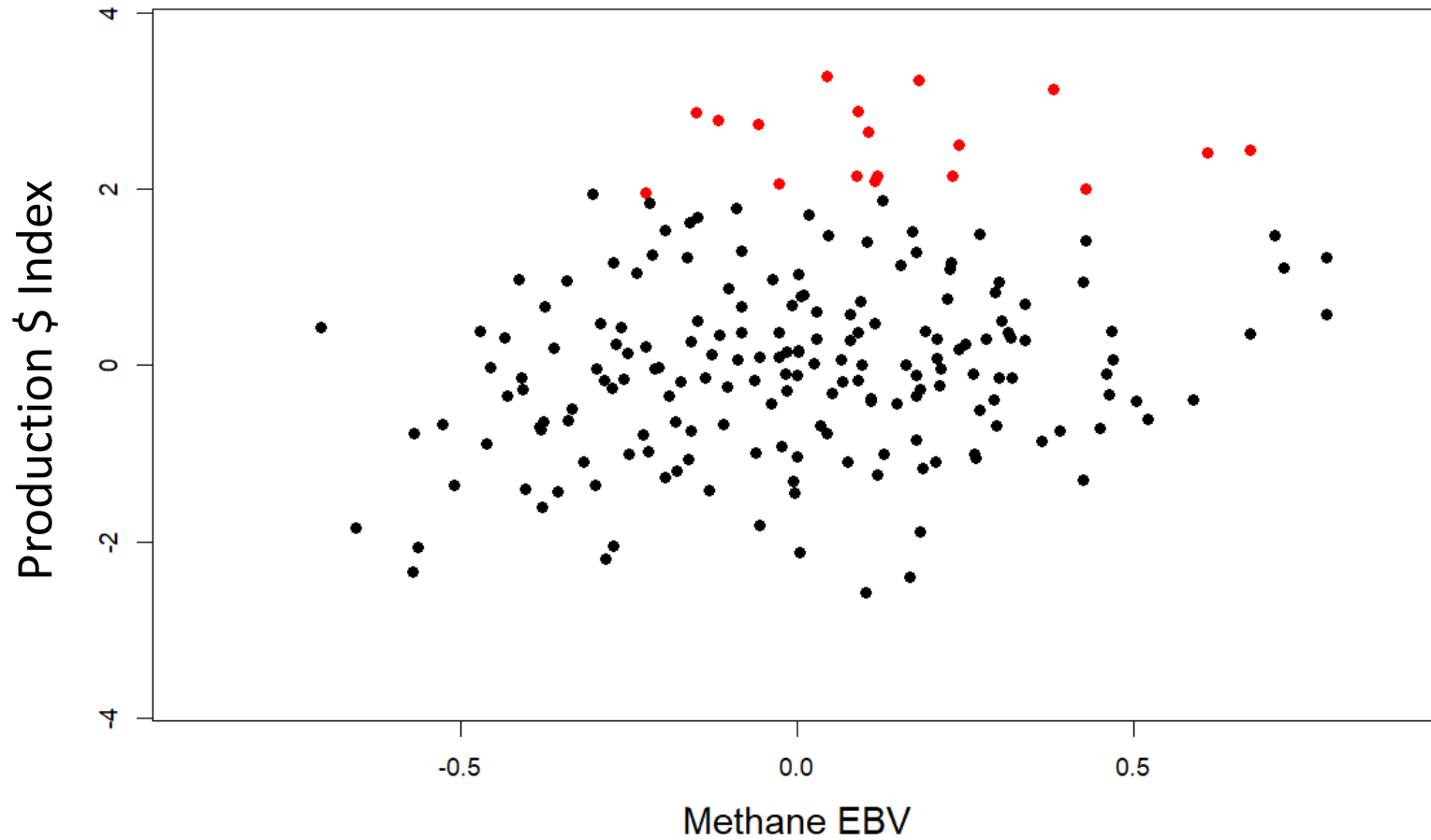
Compare scenarios with different weighting on methane EBVS

Will be mostly looking at a sheep example
but principles may apply generally across all ruminants

Balancing a Production \$ Index with methane EBVs



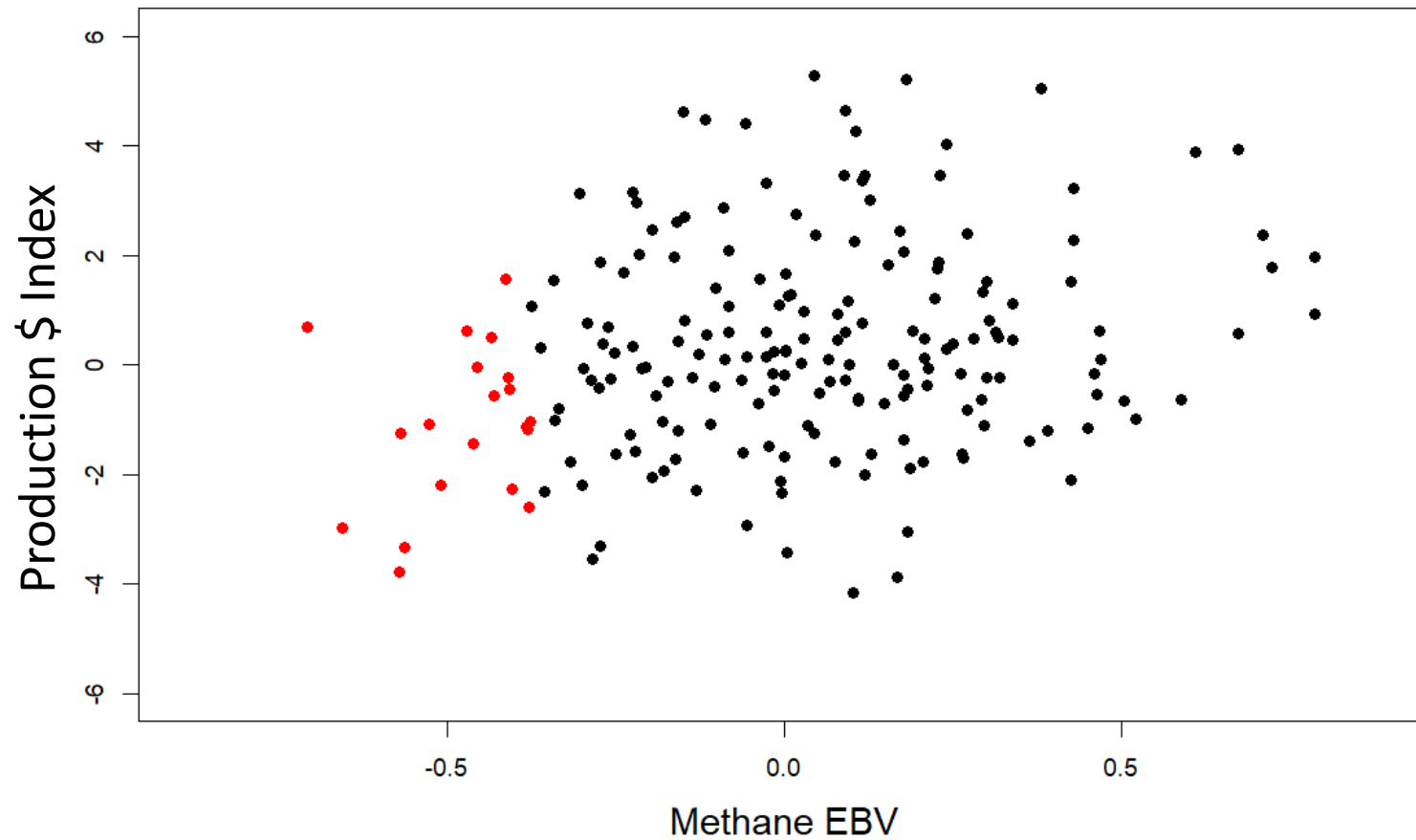
Balancing a Production \$Index with methane EBVs



Option 1:

Ignore methane

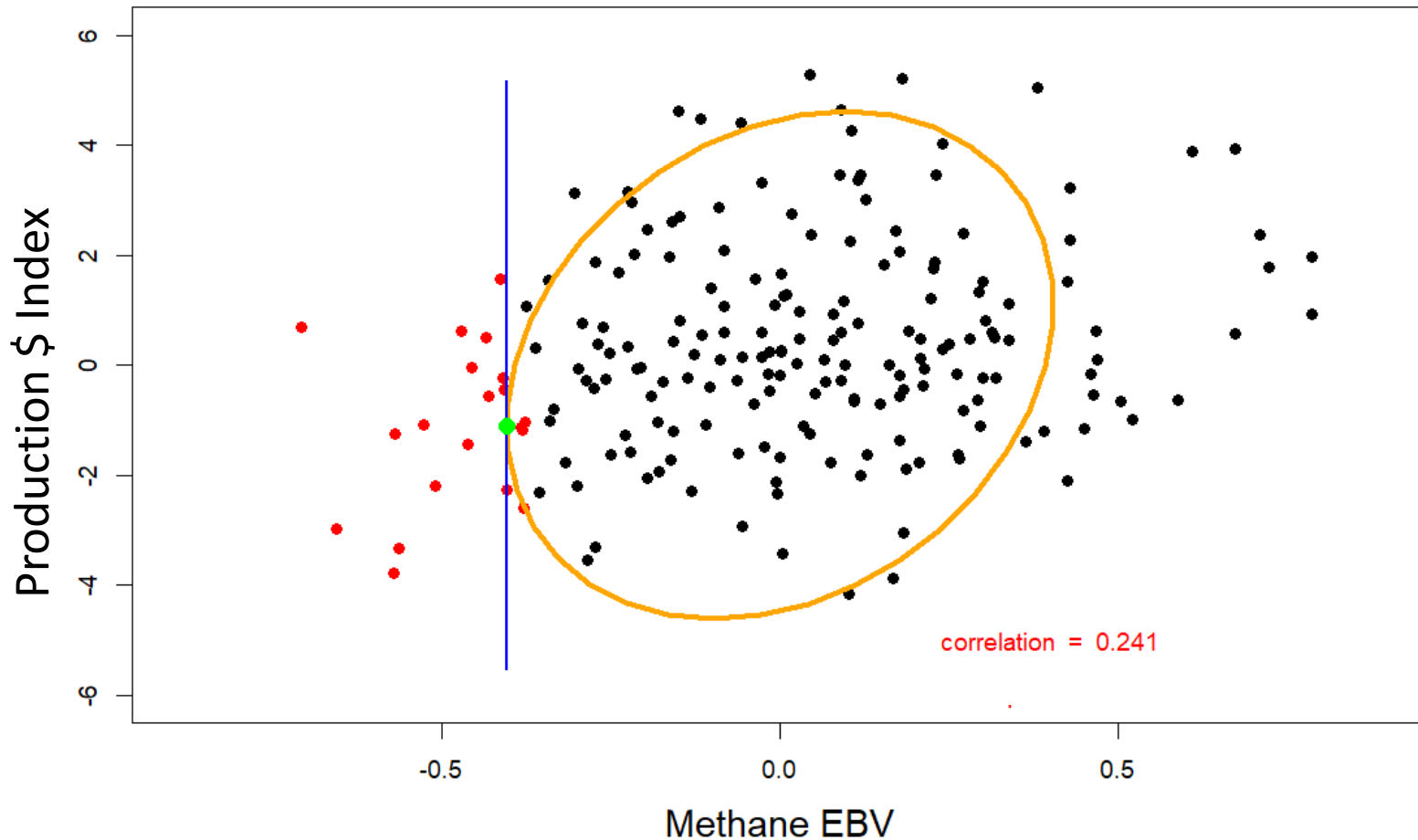
Balancing a Production \$ Index with methane EBVs



Option 2:

All you eggs on
methane

Predicting Response to Selection



Option 2:

All you eggs on methane

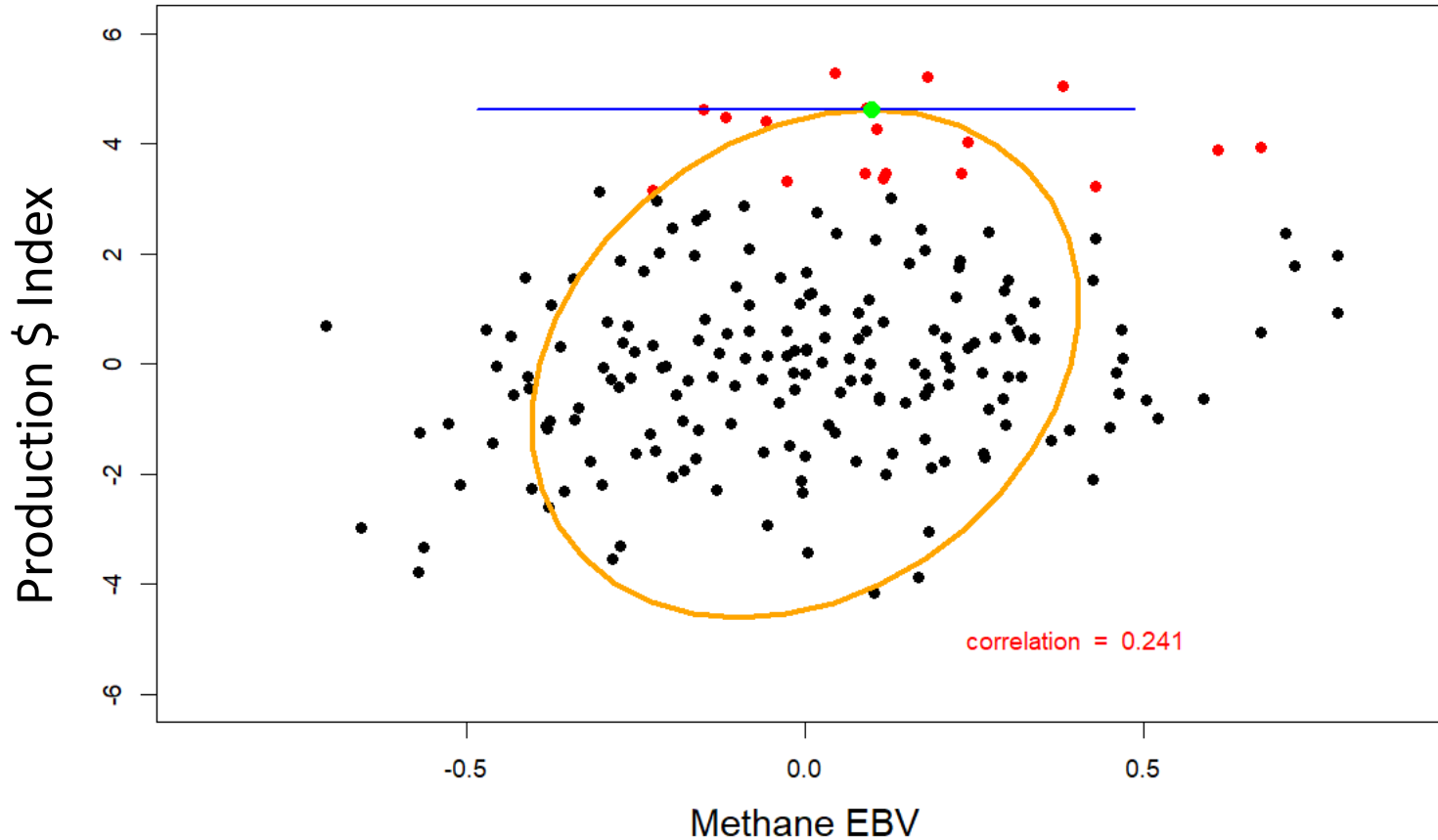
Annual response to selection

Production Index \$ -1.11

Methane (g/d) -0.40

(-1.7%)

Predicting Response to Selection



Option 1:

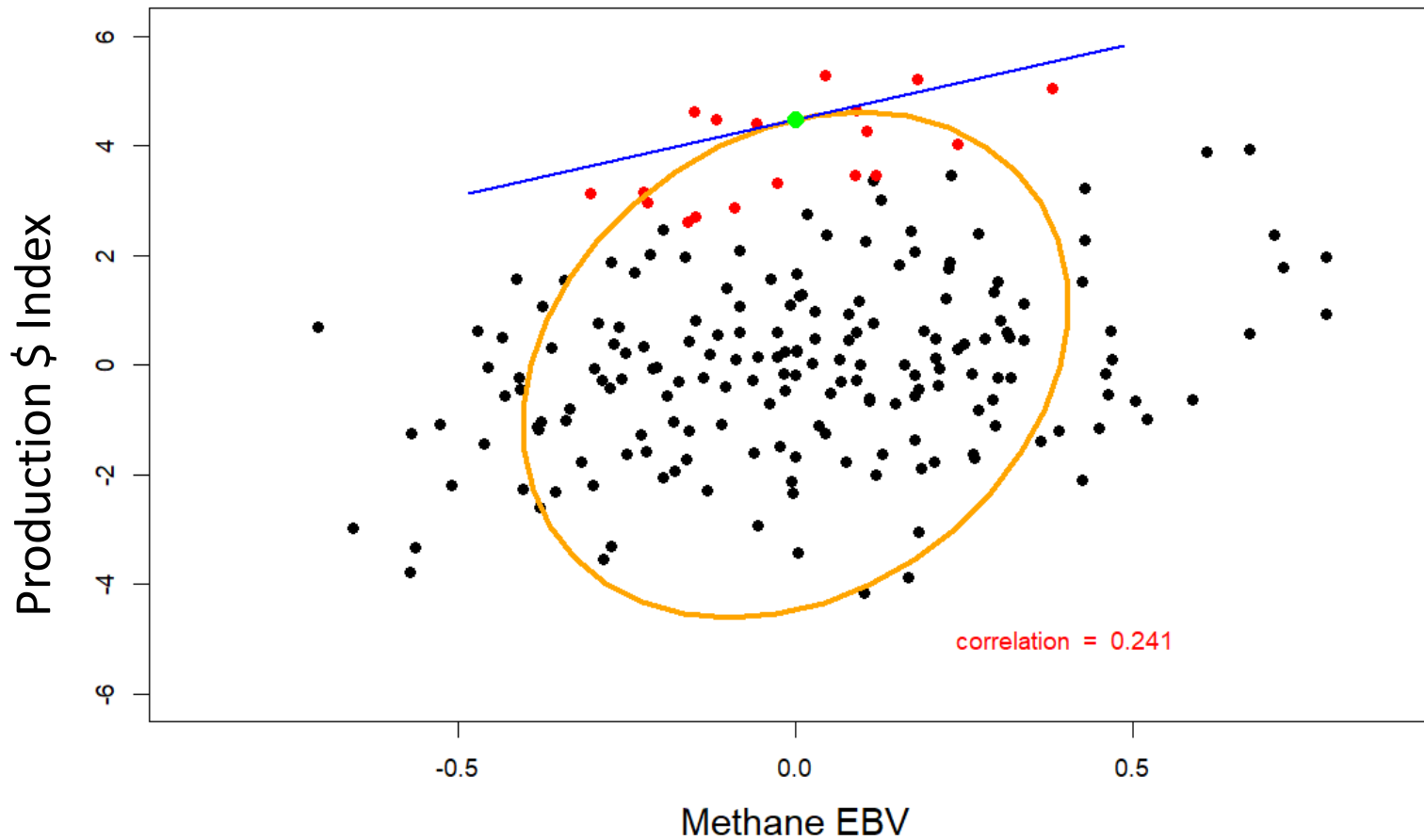
Ignore methane

Annual response
to selection

Production Index \$ 4.61

Methane (g/d) 0.10

Predicting Response to Selection



Option 1.5:

Some weight on methane

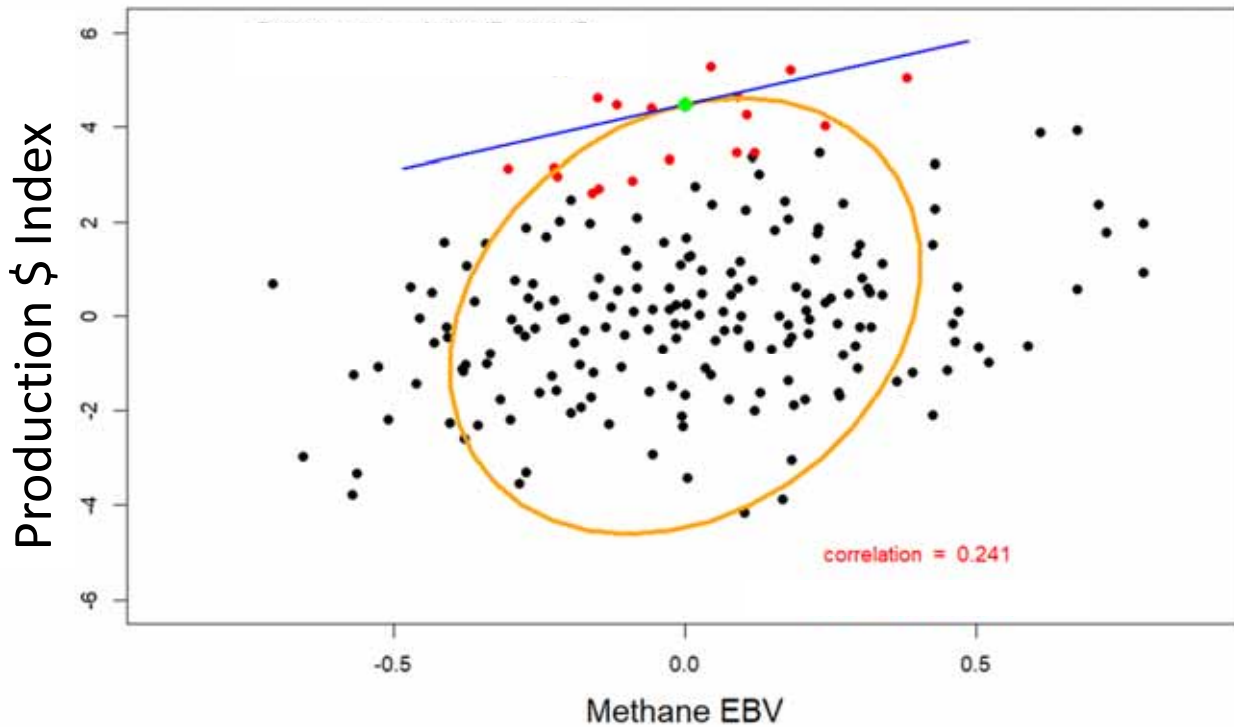
→ Implied carbon price here ~ € 100

Annual response to selection

Production Index \$ 4.47

Methane (g/d) 0.00

Predicting Response for all possible options

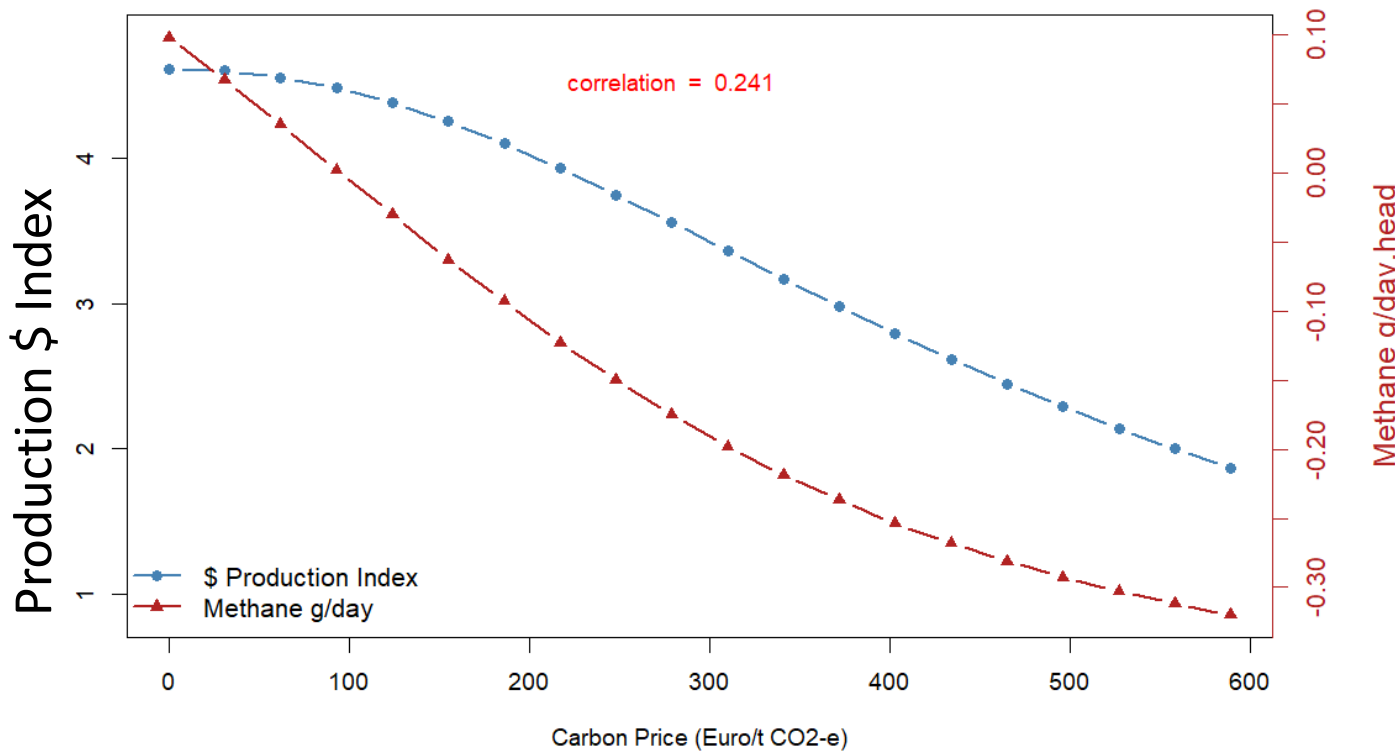


Note: Responses are not changing in a linear way

	change per annum	
Carbon price €	Response Index	Response Methane
0	4.61	0.10
25	4.60	0.07
62	4.56	0.03
124	4.38	-0.03
248	3.75	-0.15
496	2.29	-0.29
49600	-1.11	-0.40

- Key parameters:
- Variation in EBV
 - Correlation between EBVs
 - Ratio of econ weights → carbon price

Response to selection for the whole range of weights (aka as implied carbon price)

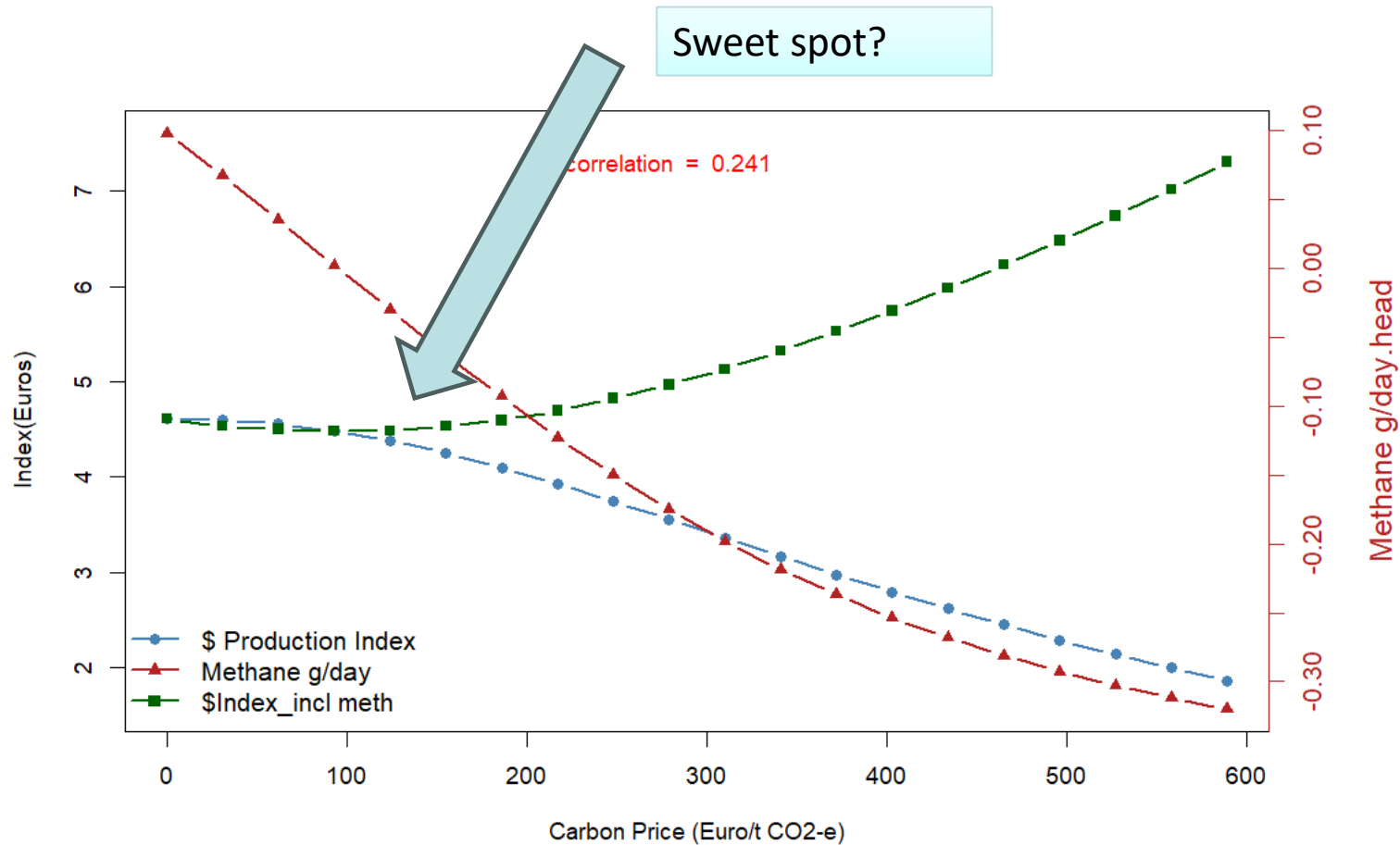


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Important parameters:

- Variation in EBV
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- Ratio of econ weights → carbon price

Balancing a Production \$Index with methane EBVs



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- Variation in EBV
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Balancing a Production \$Index with methane EBVs

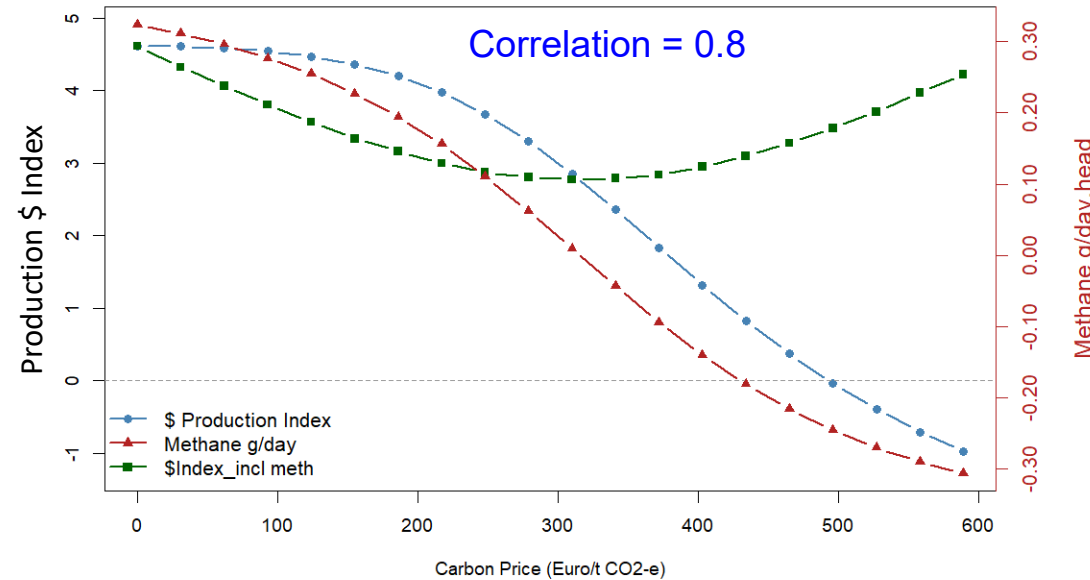
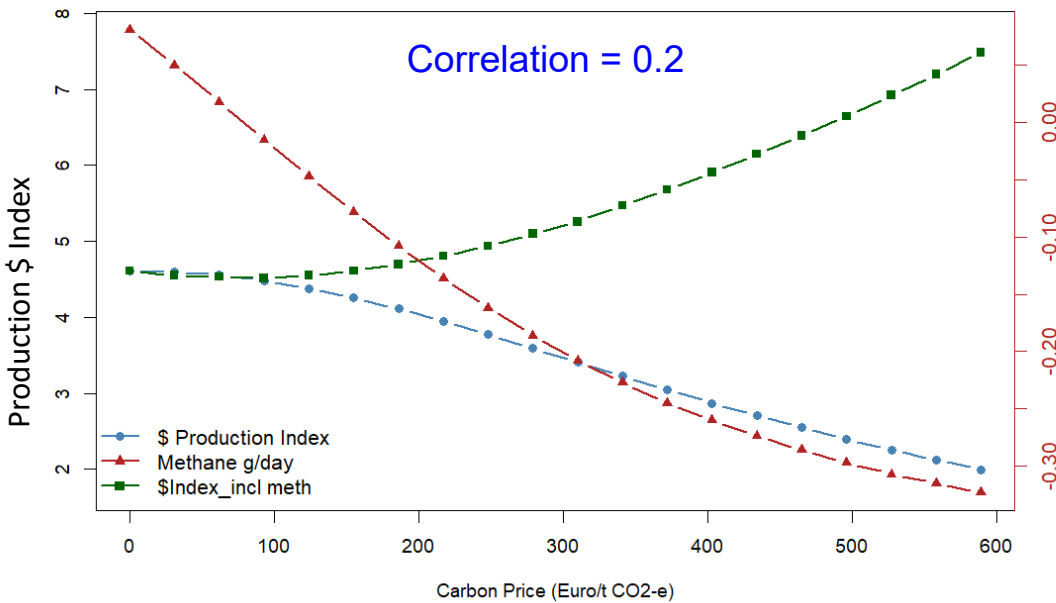
Sweet spot?

Important parameters:

- Variation in Meth. EBV → Depends on genetic parameters and EBV accuracy
- Correlation between Index and Meth EBV → Depends on genetic parameters and EBV accuracy
ST_EBV or MT_EBV?
- Ratio of econ weights → Depends on (implied) carbon price

Balancing a Production \$Index with methane EBVs

Sweet spot?

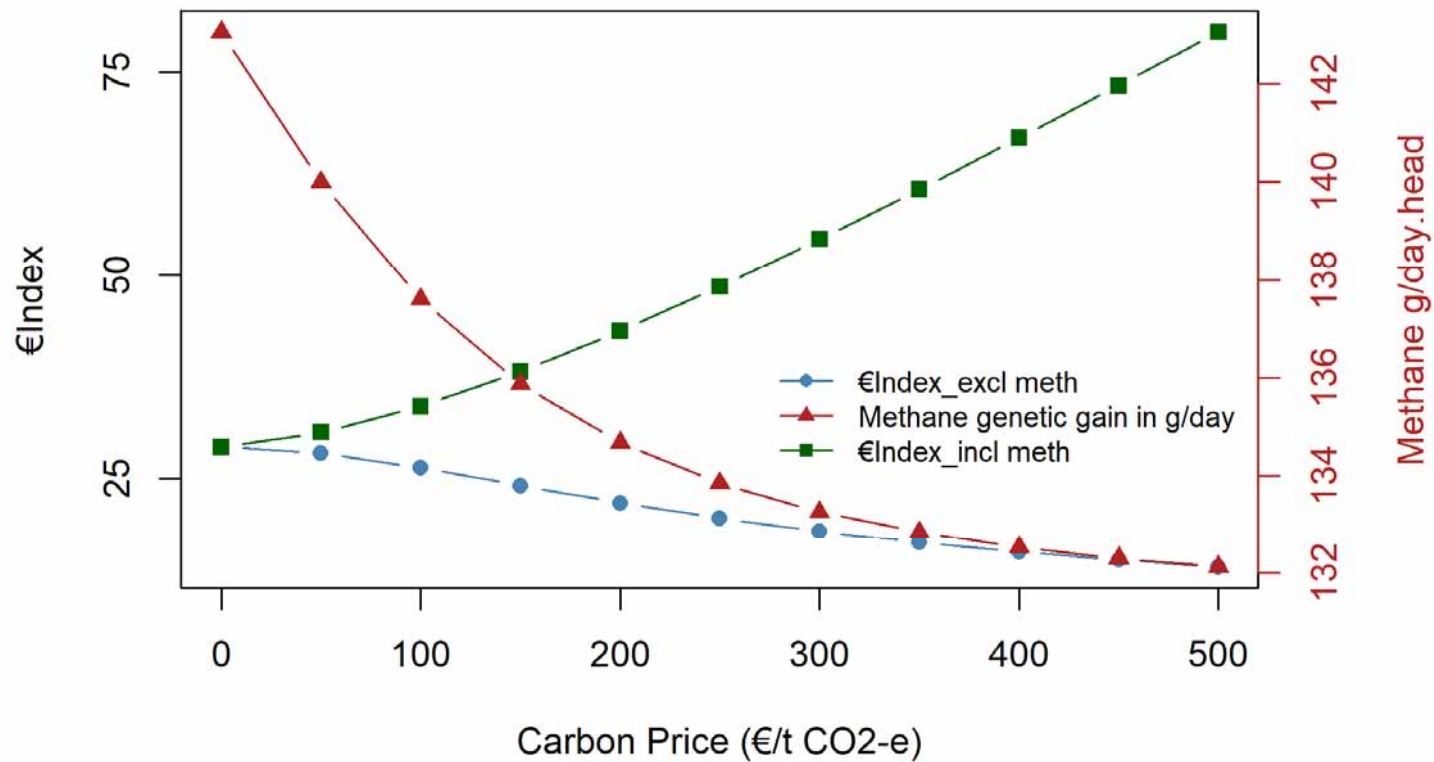


➡ With a higher correlation, harder to bring down methane without compromising \$Index (e.g. when CH₄ not measured)

➡ Applying a weight implying a carbon price of €100 to € 200 seems a low-risk strategy

Dairy example

Total Annual Genetic Gain by Carbon Price Scenario



With thanks to
Lisa Buttgen WUR

But do we need to worry about methane per head?

Perspective?:

Optimise per head
Per ha
Per kg product
Per country

profit / productivity / feed / methane

Stakeholders:

Farmers:

Profit (and sustainability)

Industry:

Product Output, Profit (and sustainability),

Governments
(and consumers)

Emissions, Product Output, Profit (and sustainability)

Reducing methane per head vs methane intensity

Product output and methane emission per breeding ewe per year and methane intensity, currently and after 10 years of selection with different weights on methane, reflected as implied carbon price

	Kg Lambs per ewe per yr	Kg Methane per ewe per yr	Methane Intensity
Current	19.02	430	22.60
Carbon price €	after 10years of selection		
25	26.6	464	17.44
62	26.3	45	17.38
124	25.6	444	17.37
248	23.7	418	17.65
496	20.4	383	18.82

Sweet spot?

What if a quota is imposed?

	Ktonne lamb per year	Mtonne CO2Eqvt per year		Nr breeding ewes (M)	Ktonne lamb/year
Current	666	15.04		35	666
	after 10years of selection				
	With constant Flock size			With quota on total emission (30% reduction to 10 Mtonne CO2Eqvt)	
Carbon price €	Ktonne lamb per year	Mtonne CO2Eqvt per year		Nr breeding ewes (M)	Ktonne lamb/year
25	932	16.25		21.5	573
62	921	16.01		21.9	576
124	895	15.54		22.5	576
248	830	14.64		23.9	567
496	713	13.42		26.1	531

Sweet spot?

With a quota, optimum solution is to minimize methane intensity

Summary

- Reduce methane emissions mainly through improvement of (re)production efficiency
- A linear index is the easiest and most transparent approach,
using EBVs for methane production (and feed intake) per head (do not select on ratio traits!)
- **Relative weight for methane could be 4-8 times current carbon price of € 25**
 - Maintaining profitability and minimizing methane intensity
- Results not terribly sensitive to key parameters, i.e. valid across production systems