Feed intake genetic evaluation: progress and an index for saved feed cost

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Interest in genetics of feed efficiency

- Feed efficiency
  - Feed important variable cost
  - Environmental/greenhouse gasses
  - “More for less”
- Develop (procedure to predict) feed intake (DMI) breeding values for Dutch bulls and cows
- First genetic evaluation in 2014

DMI data

- Data from 1990 onwards:
  - Data providers
    - Wageningen Livestock Research
    - ILVO
    - Trouw Nutrition
    - Schothorst Feed Research
    - AVEVE
  - CRV
    - Alders herd – 240 cows
    - in 2019 4 more herds to follow

CRV

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DMI data

- Data criteria:
  - ≥ 3 weekly DMI records per cow per parity
  - ≥ 5 animals per experimental treatment
  - Standardise DMI (excl. experimental treatments)
  - Lactation 1, 2 and 3

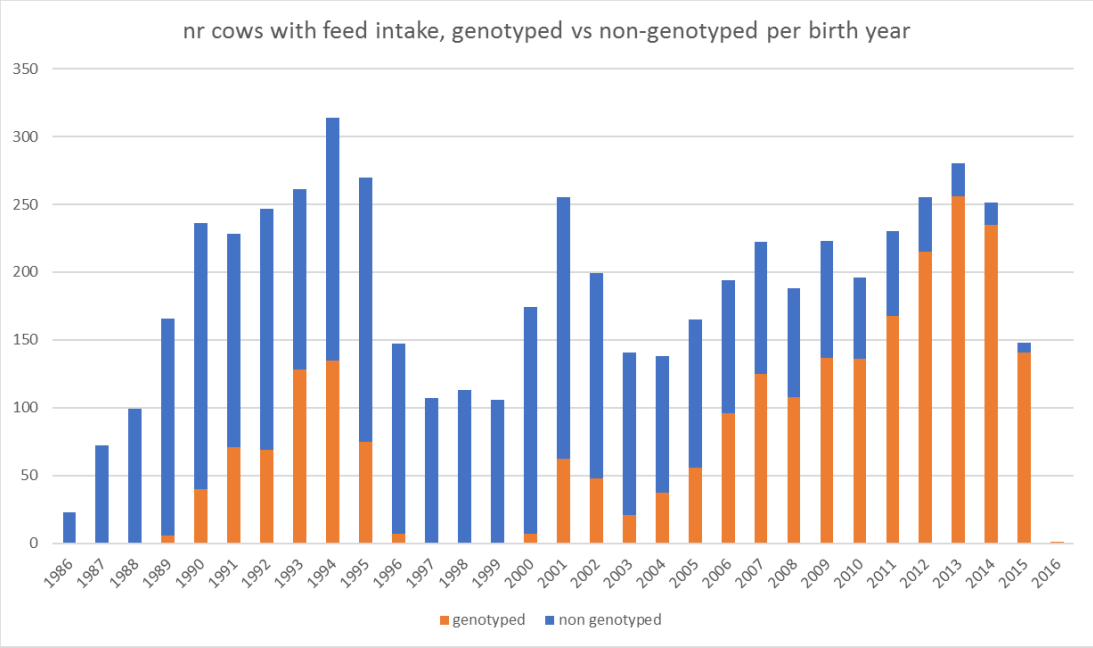
DMI data in December 2018

5649 cows with dmi data

- 2380 cows with data and genotypes
- 3269 cows with data without genotypes

5649 total cows from 1085 sires

- 530 sires with genotypes
- 555 sires without genotypes



Model for dry matter intake

Multitrait animal model

DMI1 DMI2 DMI3 = experiment
+ year*month
+ calving season
+ age at calving
+ stage of lactation
+ breed
+ perm. environment
+ cow
+ error

Cow: usage of pedigree and genotypes (H-matrix)

Predictor traits

- Genomic EBV DMI directly from DMI genetic evaluation combined with national EBV for four predictor traits:
  - Kg milk
  - Kg fat
  - Kg prot
  - Liveweight

Genetic correlations

	DMI1	DMI2	DMI3
Kg milk	0.55	0.58	0.56
Kg fat	0.58	0.60	0.58
Kg prot	0.59	0.61	0.59
LiveWeight	0.67	0.45	0.41

- Selection index weighted based on reliabilities
- Model reliability

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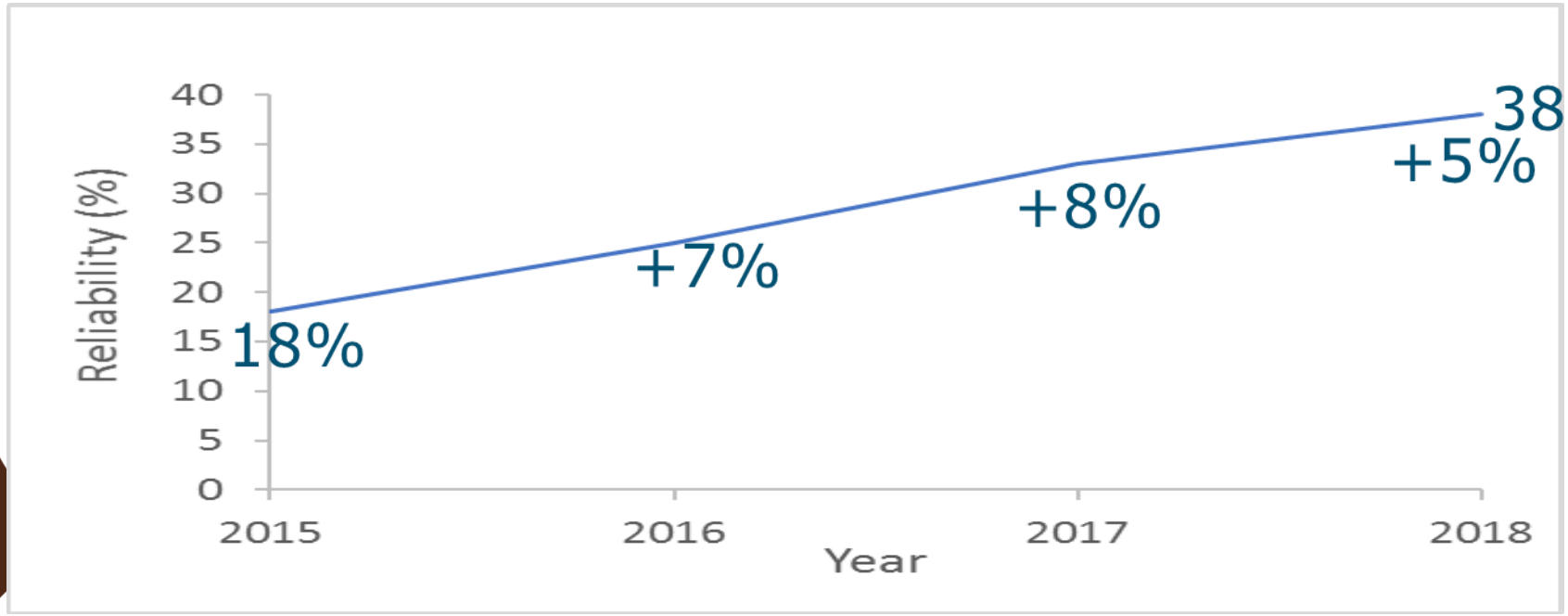
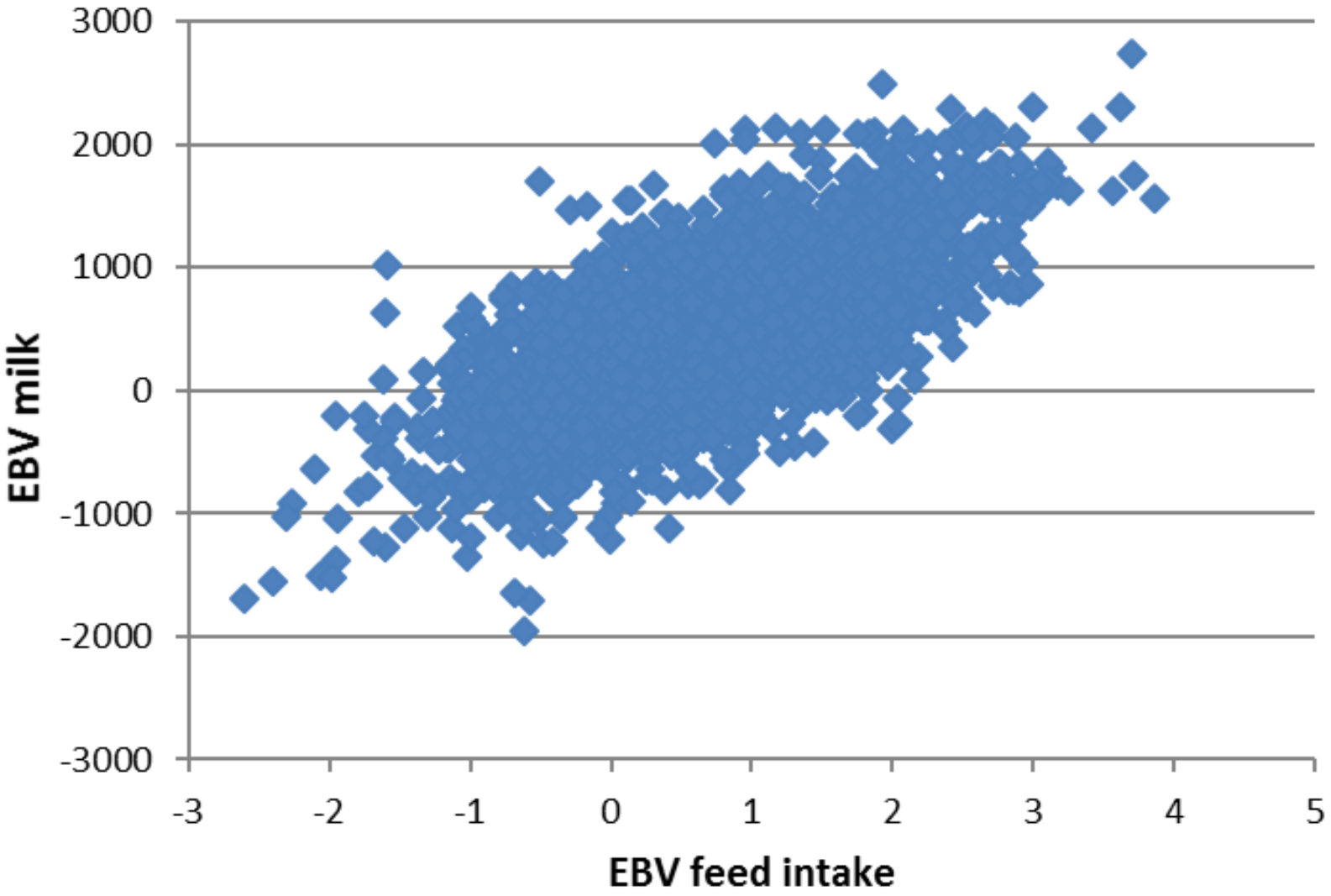
Reliabilities DMI – only genomics

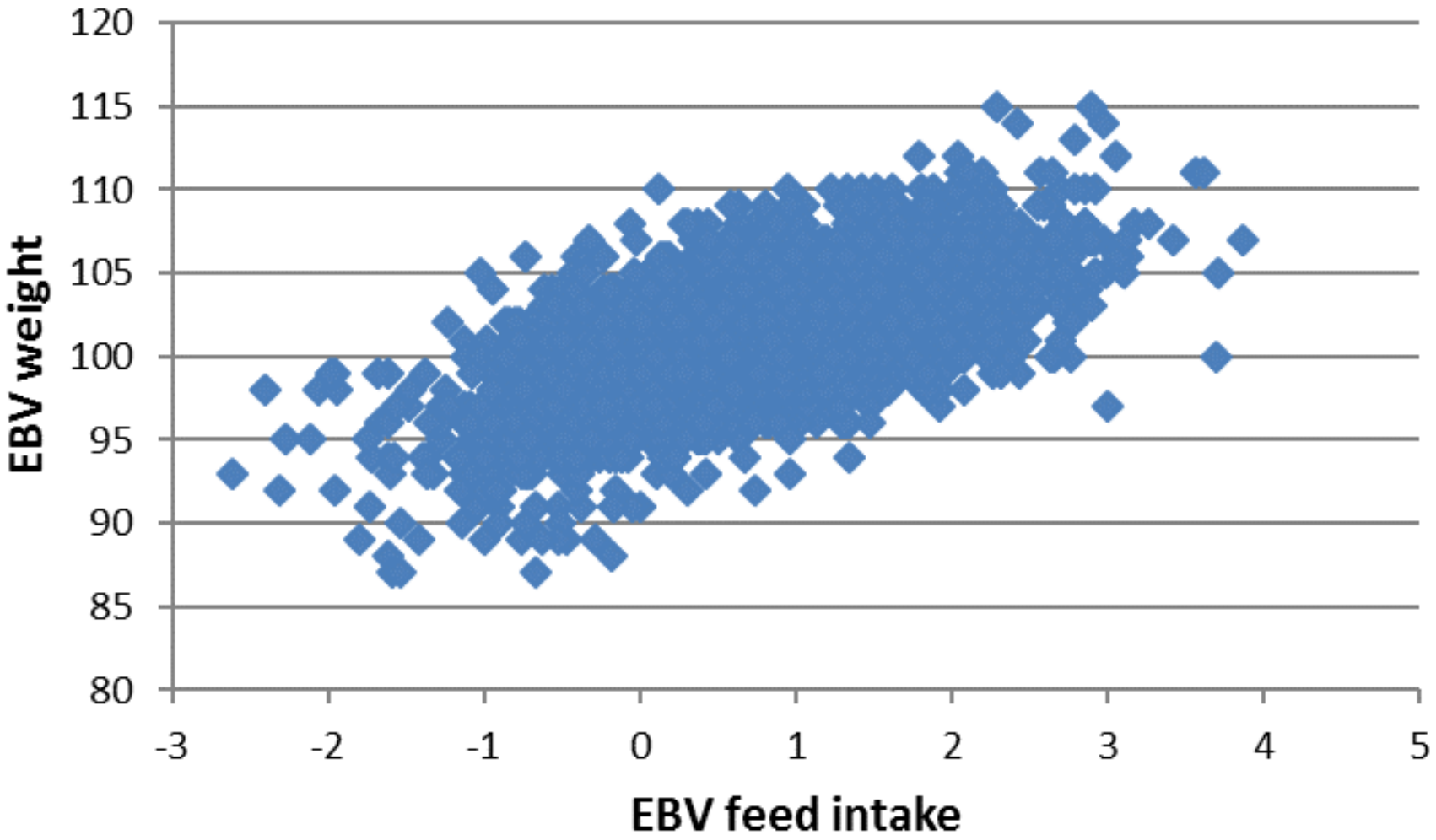
2015	2016	2017	2018
55,437 rec	+ 22,391 rec	+ 51,610 rec	+ 30,510 rec
2,249 anim	+ 965 anim	+ 1,149 anim	+ 1,082 anim
123 exp	+ 429 exp	+ 368 exp	+ 182 exp
2,922 lact	+ 1,502 lact	+ 2,529 lact	+ 1,409 lact



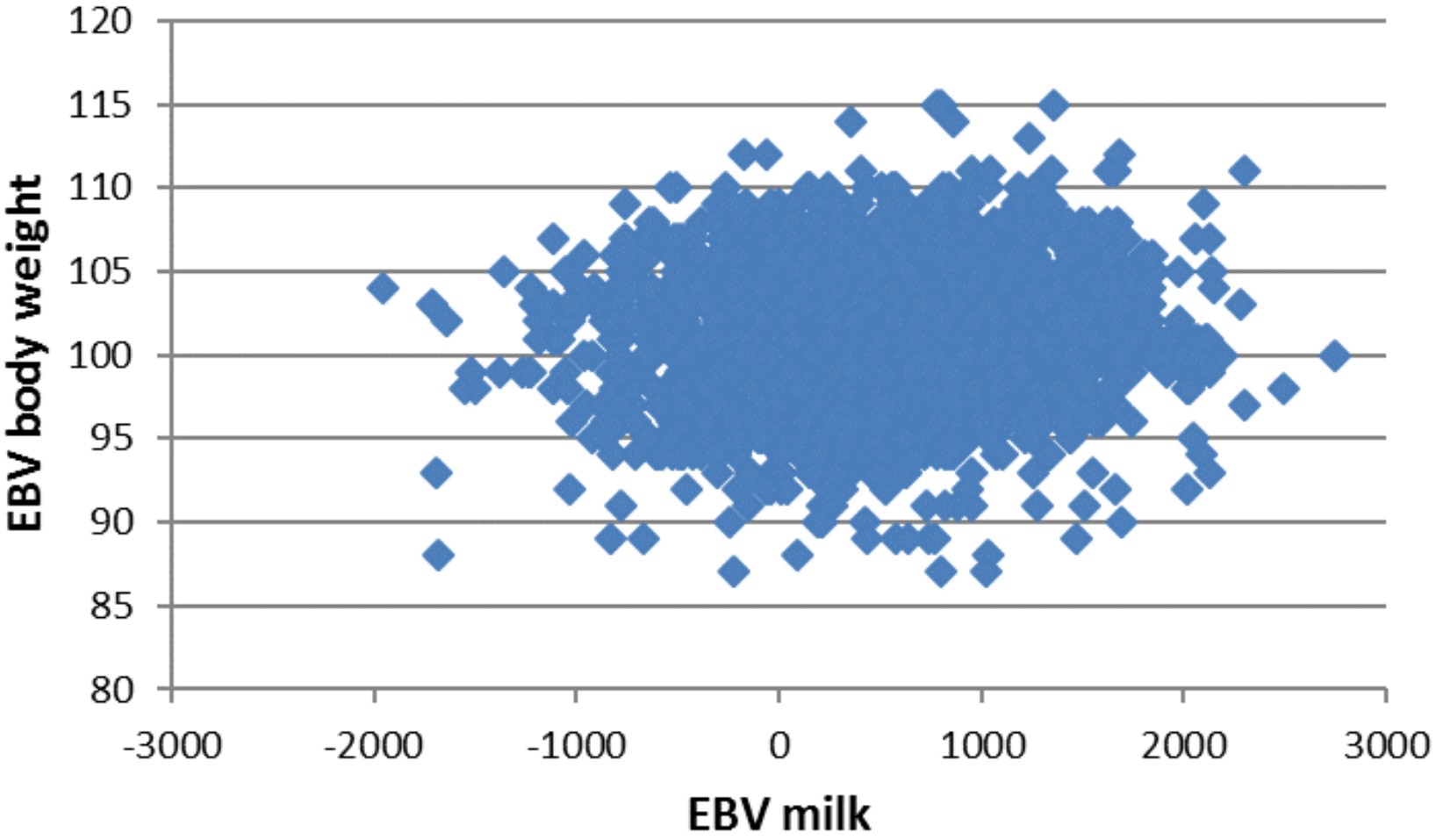
Milk versus dry matter intake



Body weight vs dry matter intake



Milk versus body weight



Saved Feed Cost (SFC)

- SFC = saved feed cost for maintenance
  = feed intake – feed for production

  -> feed for:
  maintenance
  difference in digestion
  activity

- Unit: euro/lactation

Feed intake -> Feed Saved Maintenance -> Saved Feed Cost (SFC)

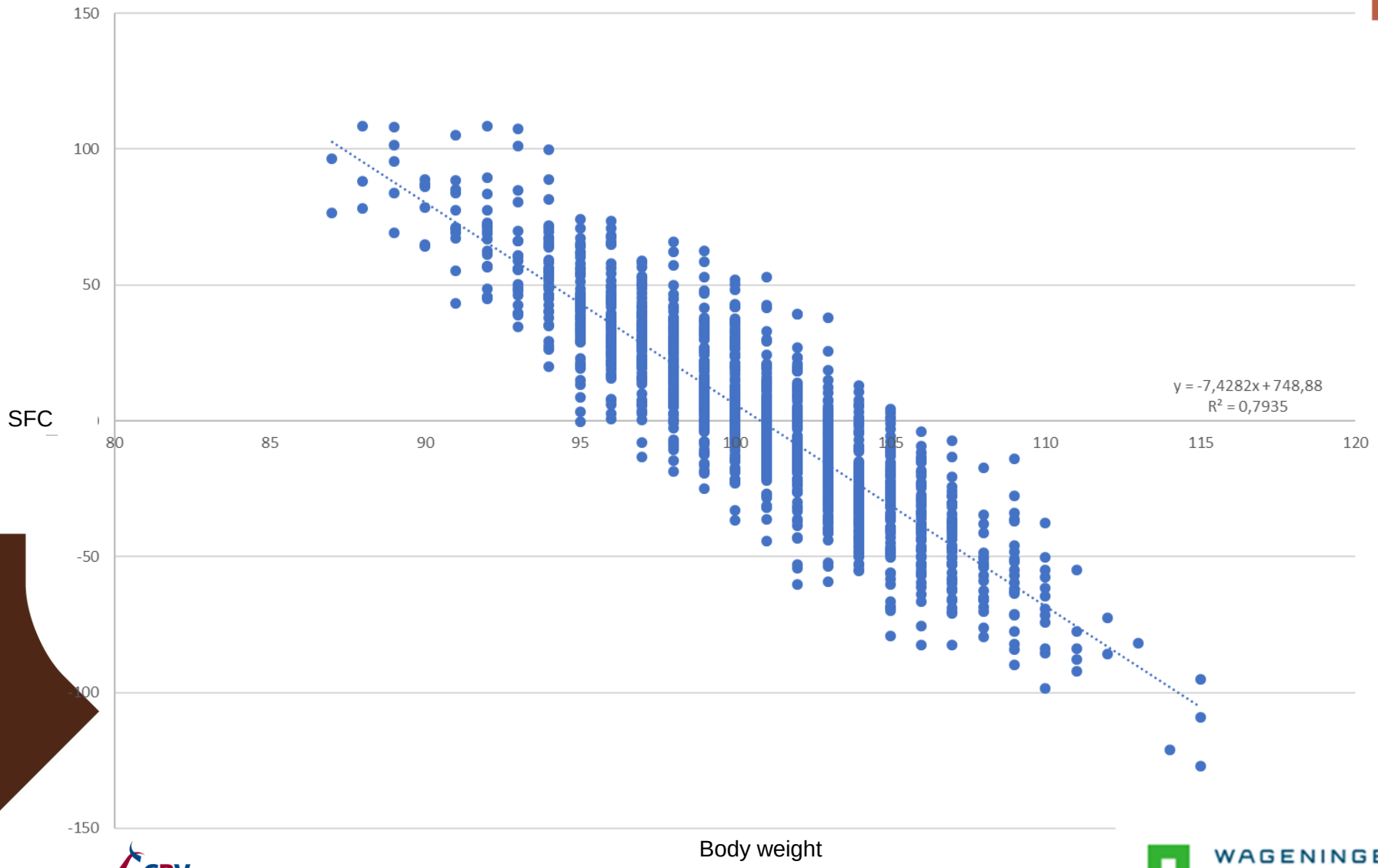
- DMI = EBV feed intake

- EBV Feed Saved for Maintenance = FSM
  - FSM = Feed for production - DMI

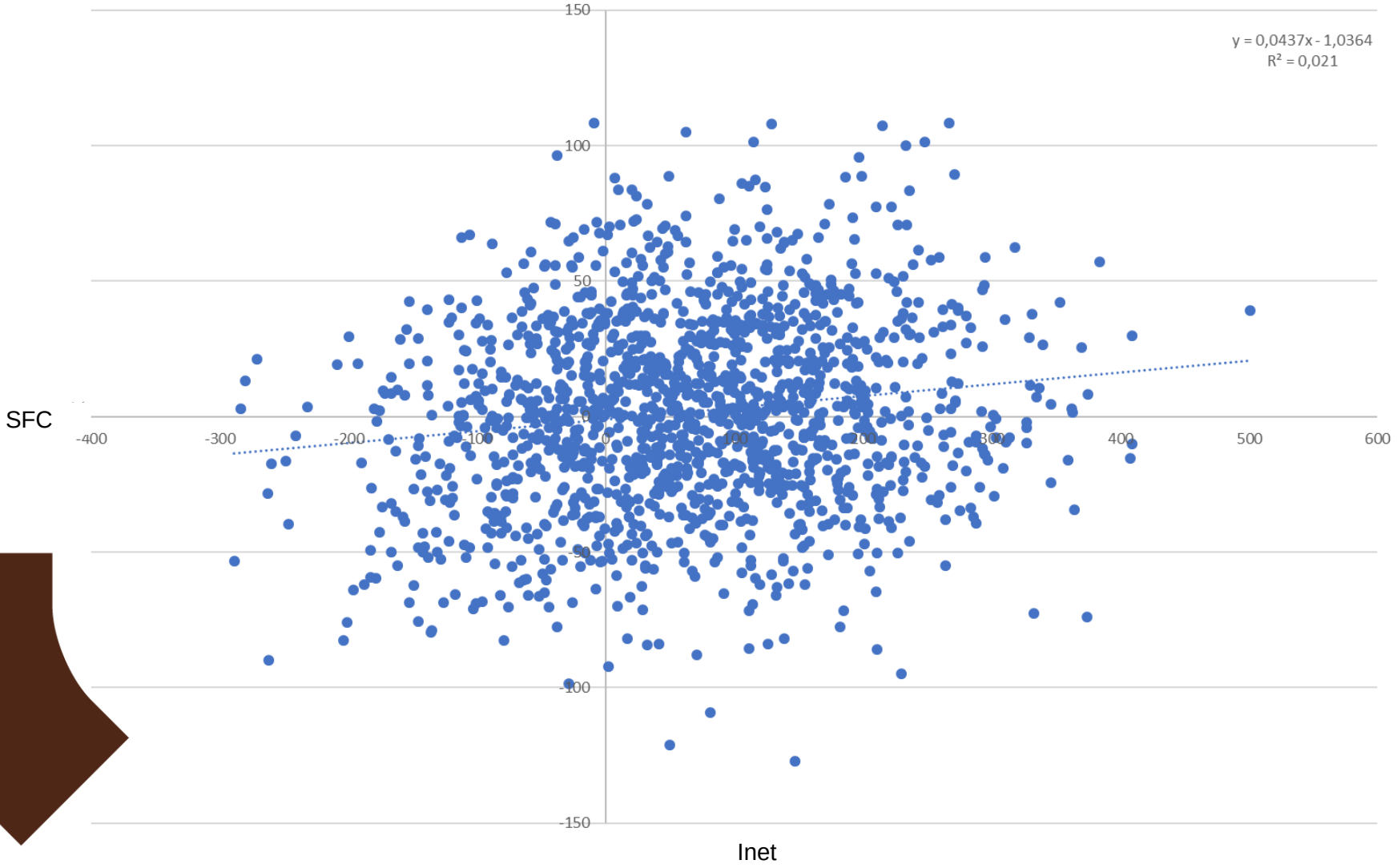
    1/.94 *(5.9 kg fat + 3.0 kg prot + 2.43 kg lactose)/301) - DMI
  - Unit: kg/day

- Saved Feed Cost for maintenance = SFC
  - FSM kg/day -> SFC euro/lactation -> 0.20 ct/kg during 305 day lactation
  - SFC = 60.2 * FSM
  - In euro / lactation

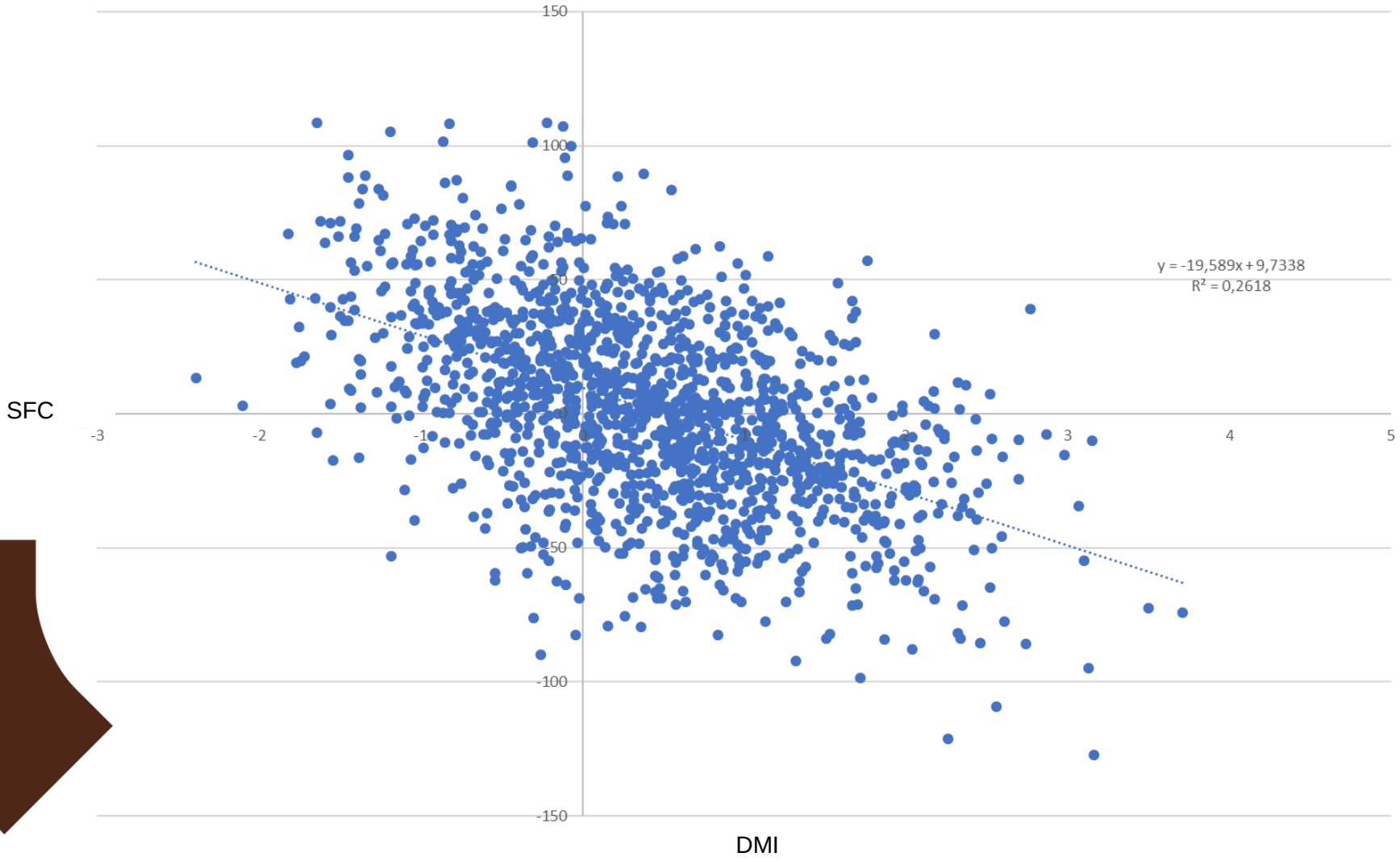
SFC – body weight



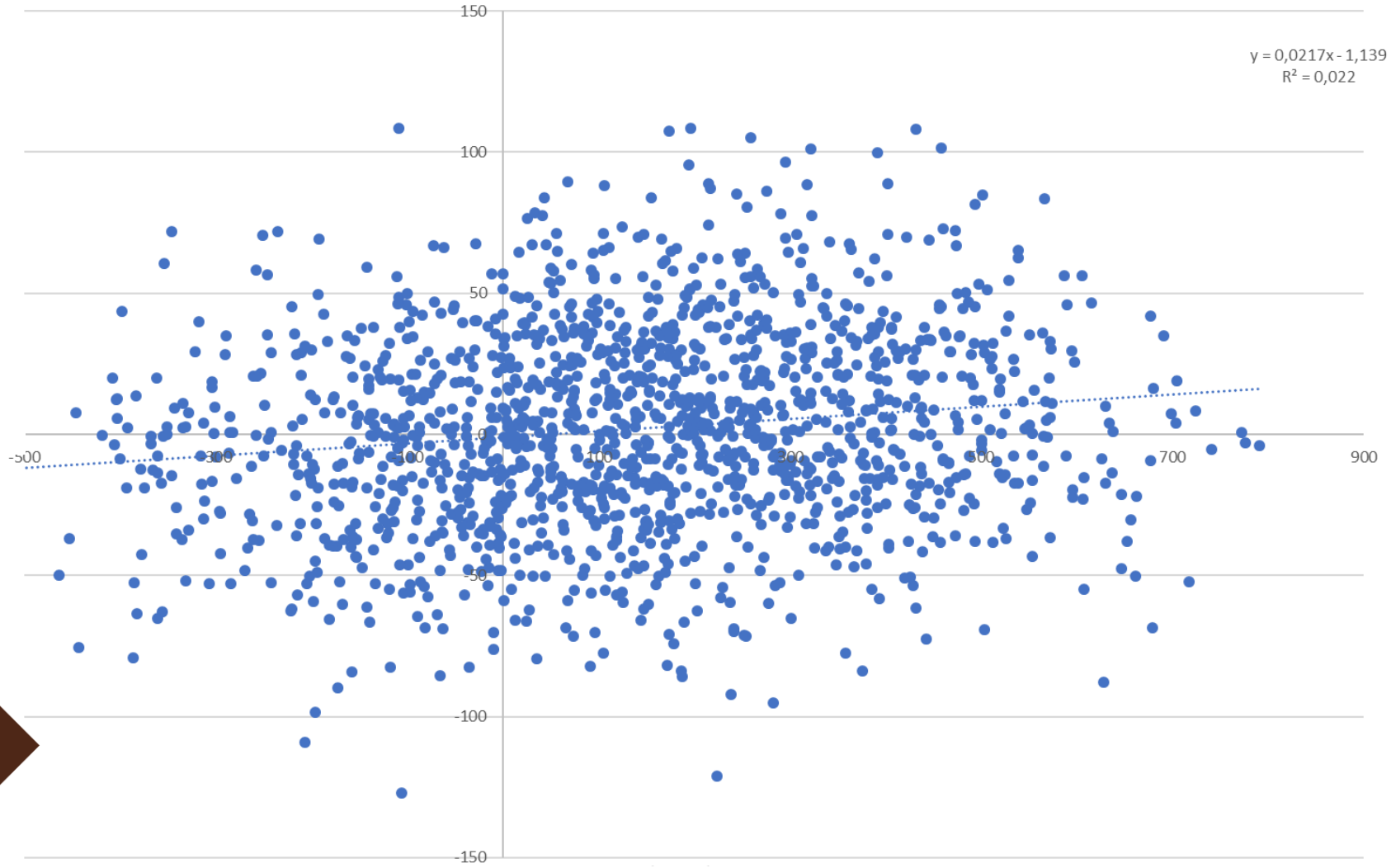
SFC -Inet


y = 0,0437x - 1,0364
R² = 0,021
150
100
50
0
-50
-100
-150
-400
-300
-200
-100
0
100
200
300
400
500
600
SFC
Inet

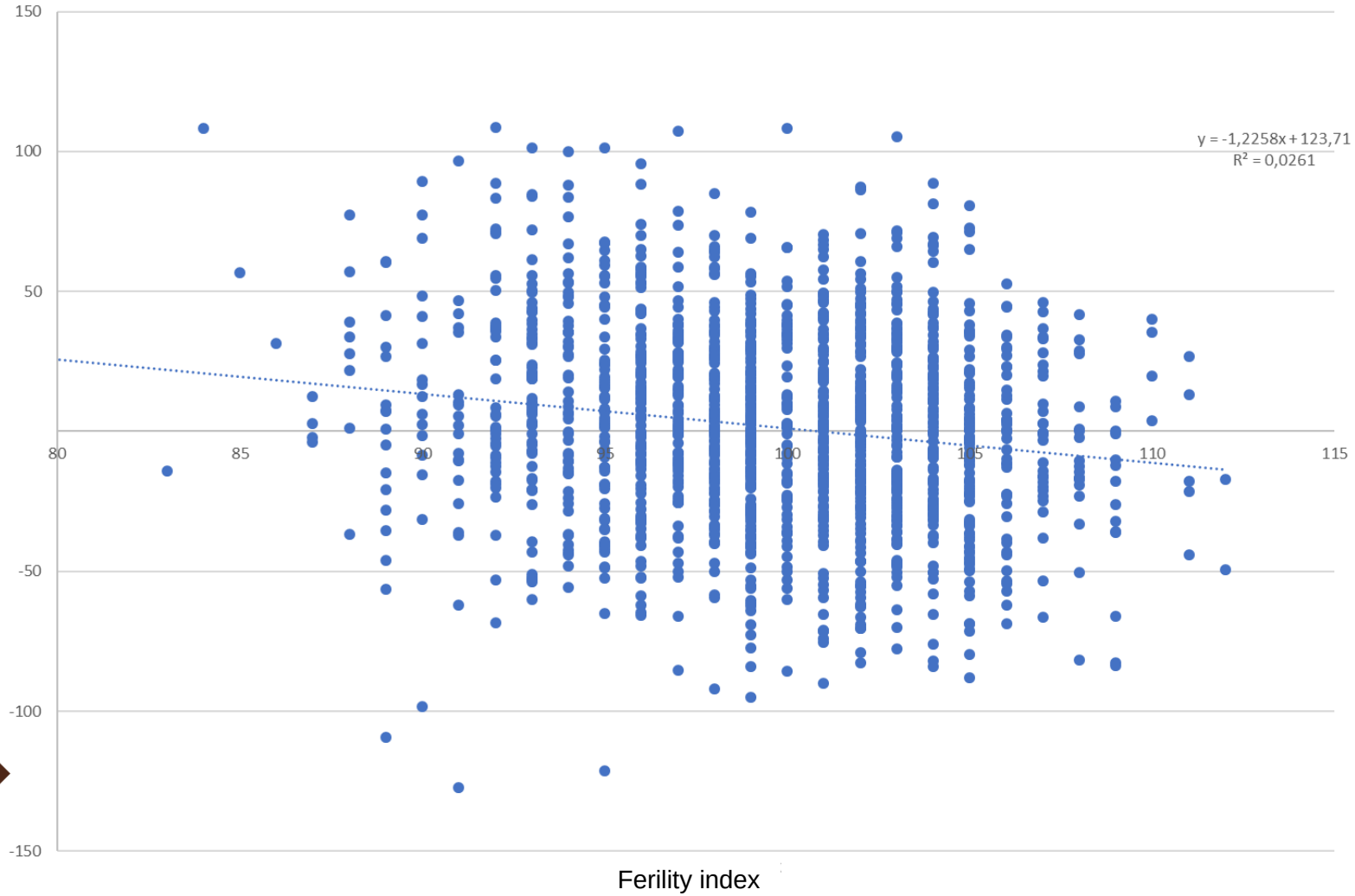
SFC – feed intake



SFC - longevity

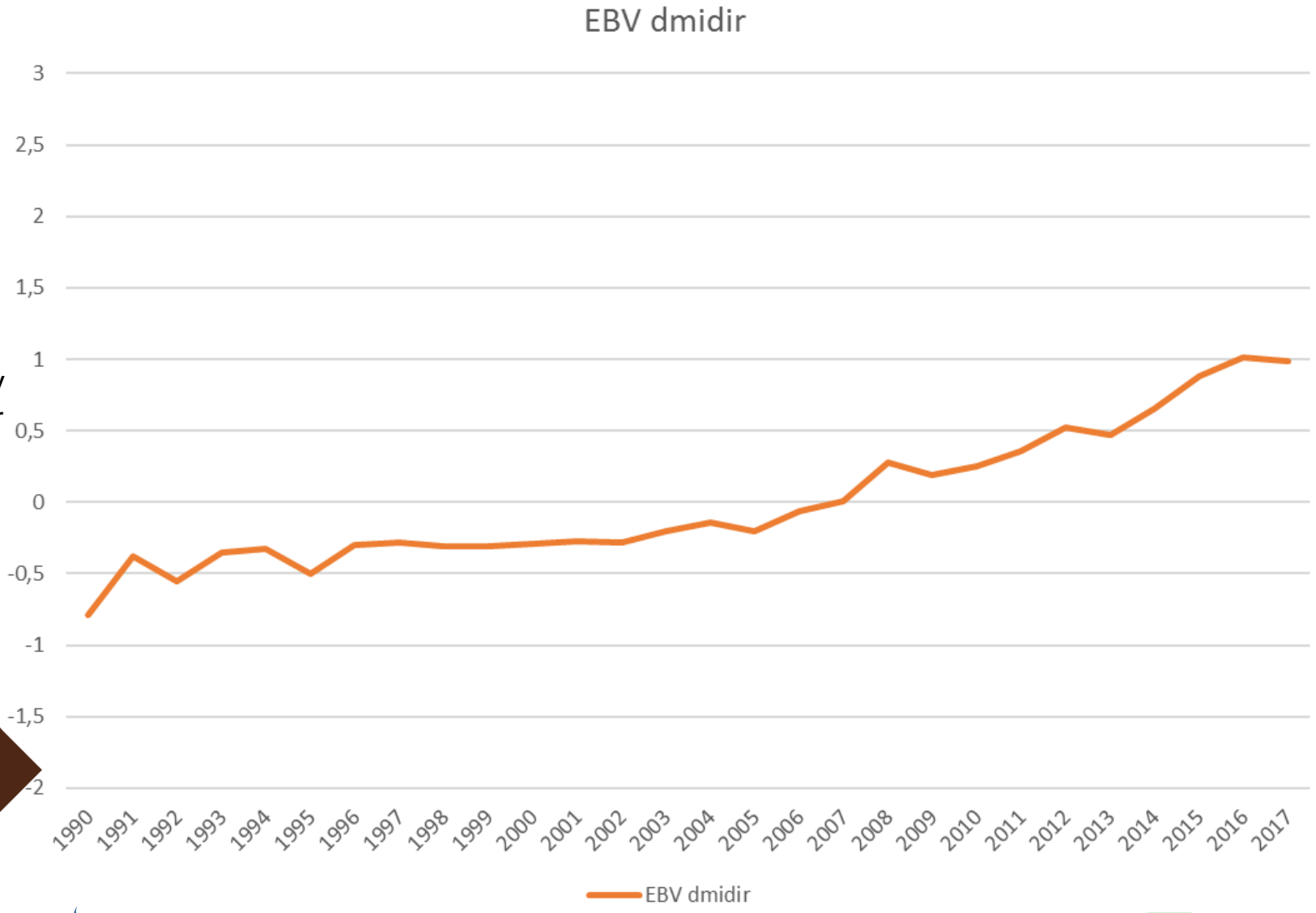


SFC - fertility



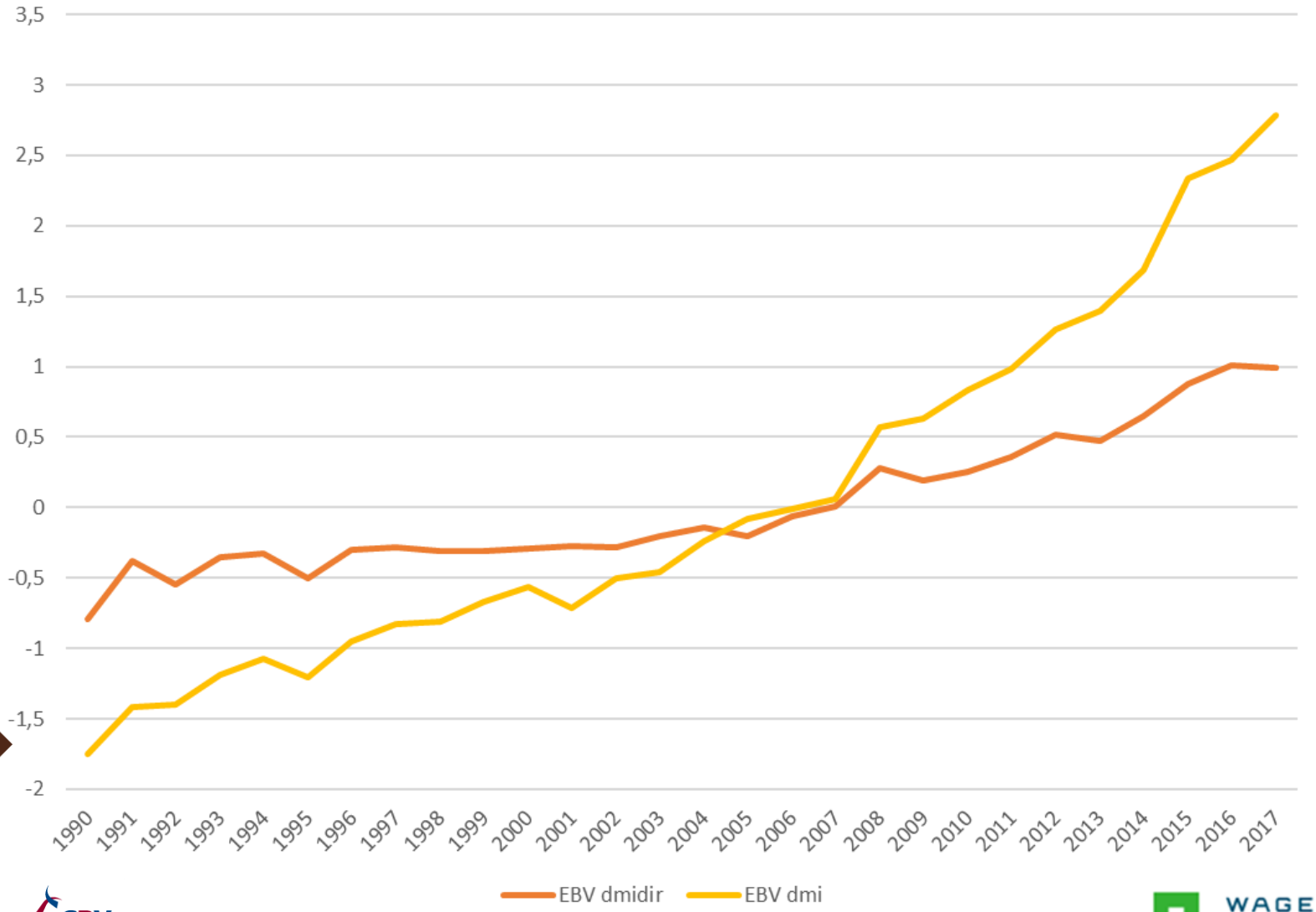
Genetic trend bulls

direct feed intake (based on offspring and genomics)



Genetic trend bulls

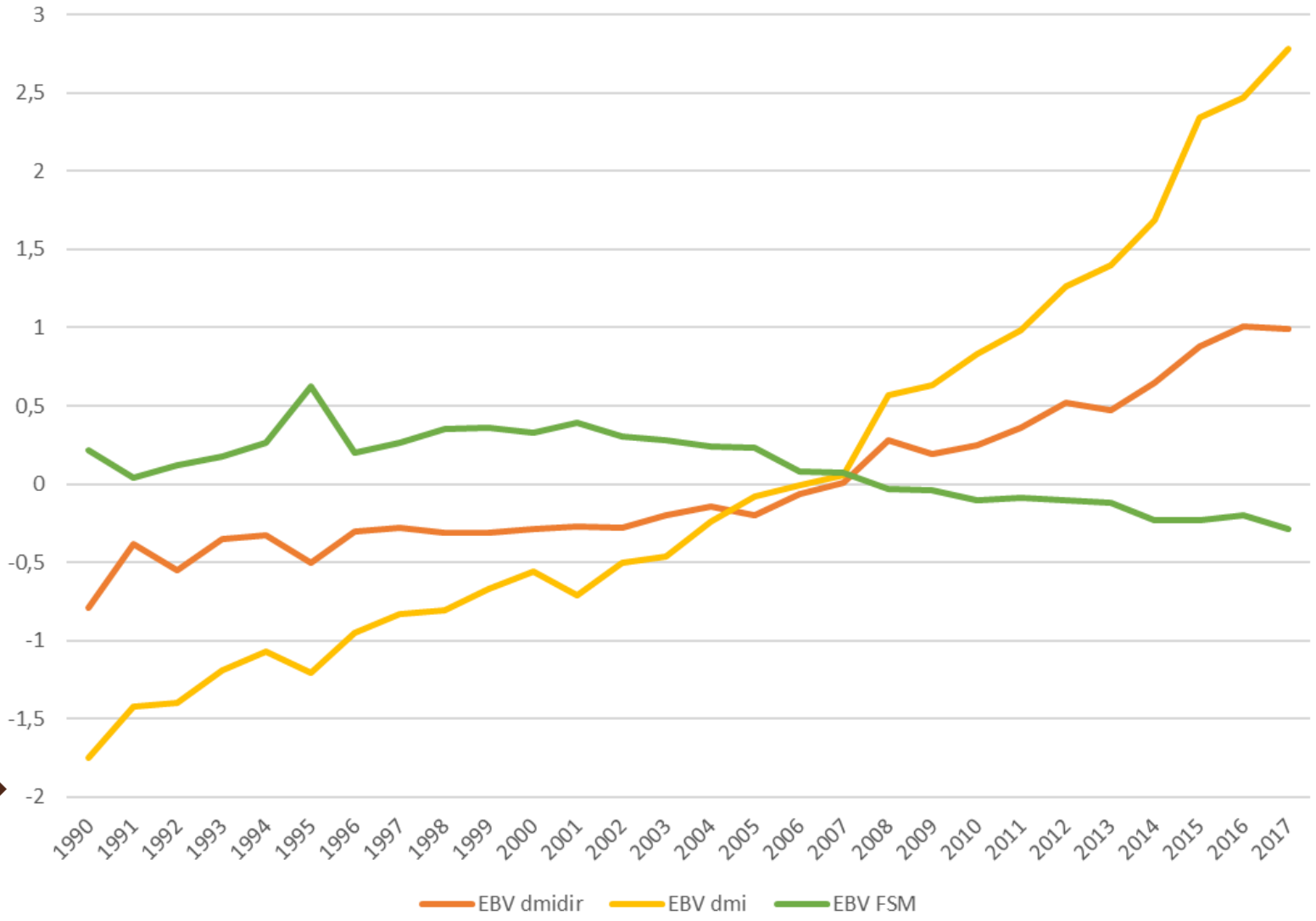
direct feed intake (dmidir) and dmi+predictors (dmi)



Genetic trend bulls

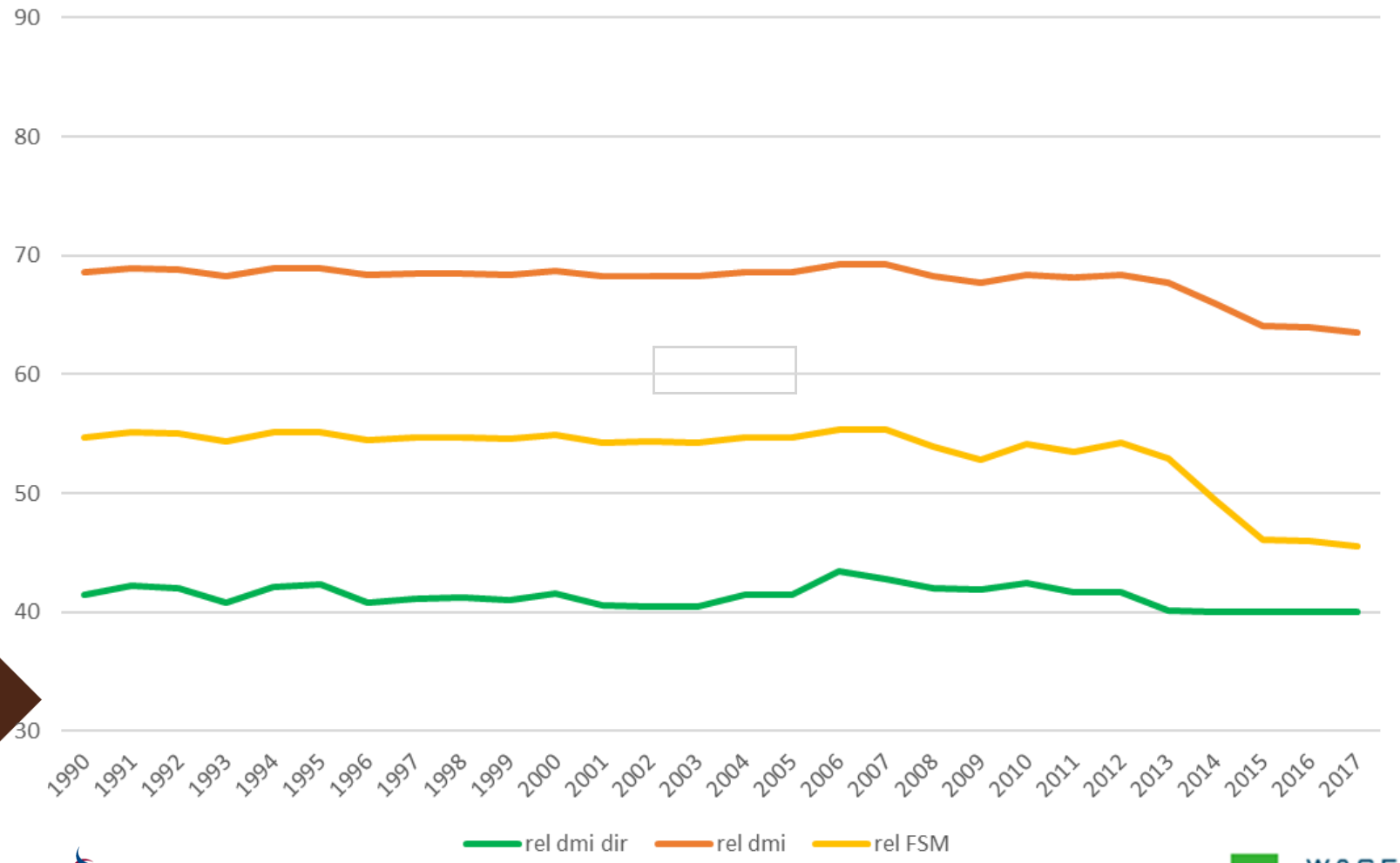
direct feed intake (dmidir) and dmi+predictors (dmi) and FSM

Kg dry matter



Reliability bulls

direct feed intake (dmidir) and dmidir+predictors (dmi) and FSM



Total merit index - NVI

	NVI 2018	Rel weight
Inet	0,40	29%
Longevity	0,08	12%
Udder health	4,7	12%
Fertility	6,3	16%
Udder	1,8	5%
F&L	3,6	9%
Calving traits index	1,8	5%
Claw health	2,7	7%
Saved Feed Cost	0,23	5%

NVI = 0.4*Inet +0.08*Ion +4.7*UDH +6.3*FER +1.8*Udder +3.6*F&L +1.8*CAL +2.7*CLW + 0.23***SFC**

Final remarks

- 5600 cows with feed in take data
  - Increase over the years (about 1000/year)
  - Increase in genomic reliability
- DMI used to define SFC
  - SFC part of NVI
- Big step to breed for efficient cow