Genetic evaluation for feed intake in the Netherlands and Flanders. impact on efficiency and responses

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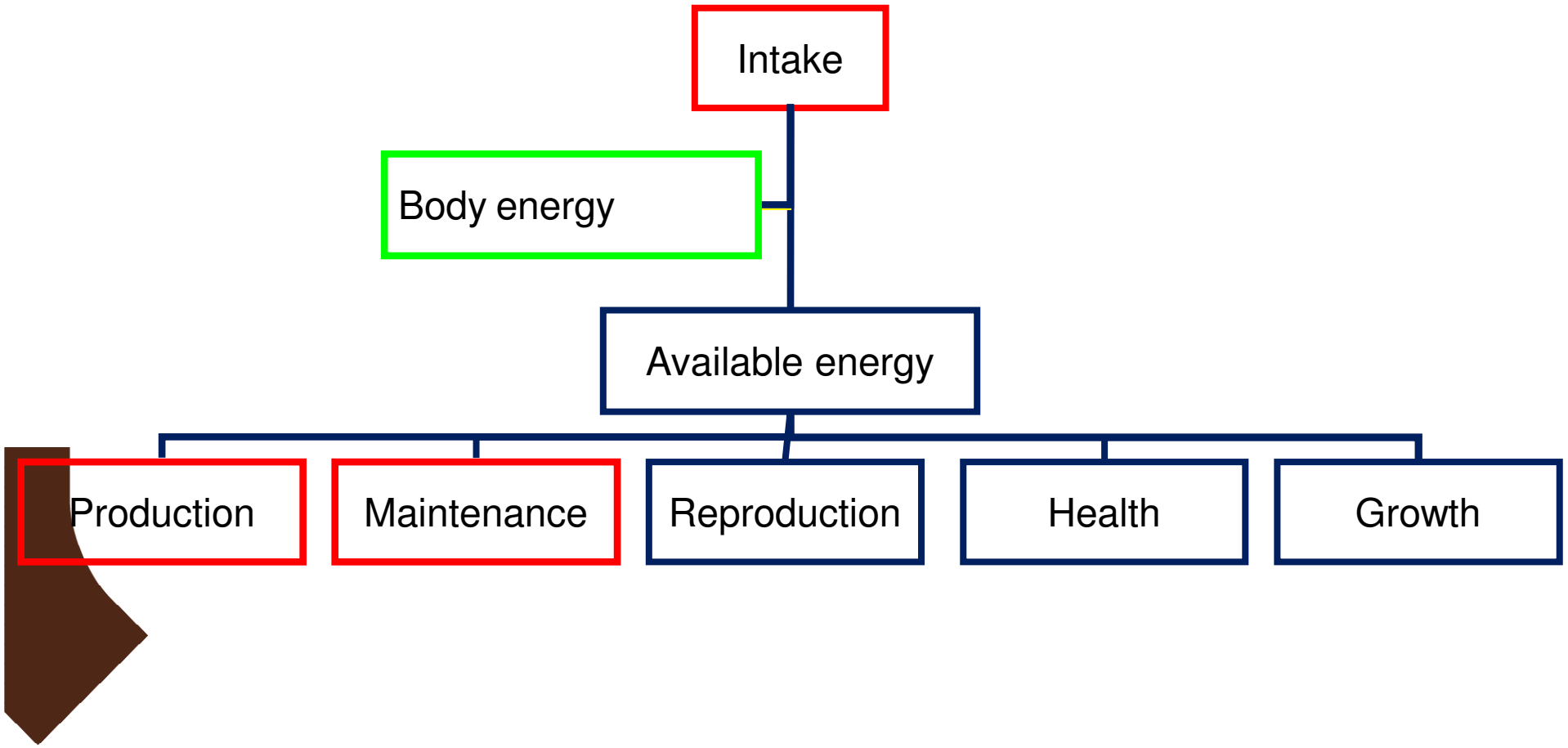
Interest in genetics of feed efficiency

- 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

How is feed used?



Using feed intake data

1. Data on 3200 cows in lactation 1,2 and 3
    - collection of feed intake, milk yield and body weight
    - genotypes (1300 cows + sires of cows)

2. Parameters estimated
    - base for routine evaluation

Parameters (1)

Trait	h2	Genet. Stdev (kg/day)
Dmi lact 1	0.28	1.24
Dmi lact 2	0.25	1.39
Dmi lact 3	0.20	1.51

Parameters (2) – genetic correlations

	dmi1	dmi2	dmi3	milk	fat	protein	body weight
dmi1							
dmi2	0.88						
dmi3	0.80	0.89					
milk	0.55	0.58	0.56				
fat	0.58	0.60	0.58	0.50			
protein	0.59	0.61	0.59	0.91	0.65		
body weight	0.67	0.45	0.41	0.10	0.10	0.10	

Using feed intake data

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3. Model routine evaluation

Model for dry matter intake

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

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

Using feed intake data

1. Data on 3200 cows in lactation 1,2 and 3
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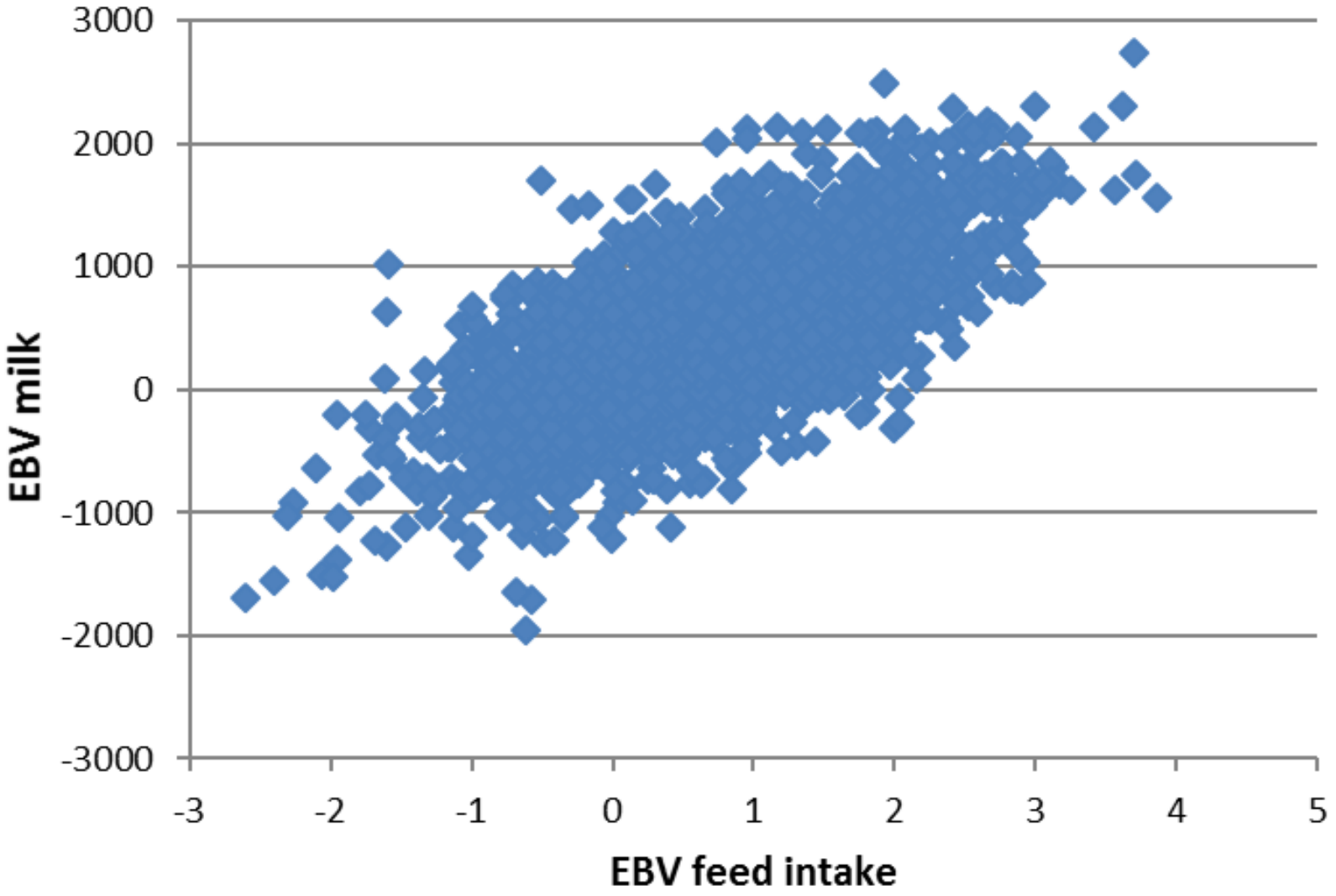
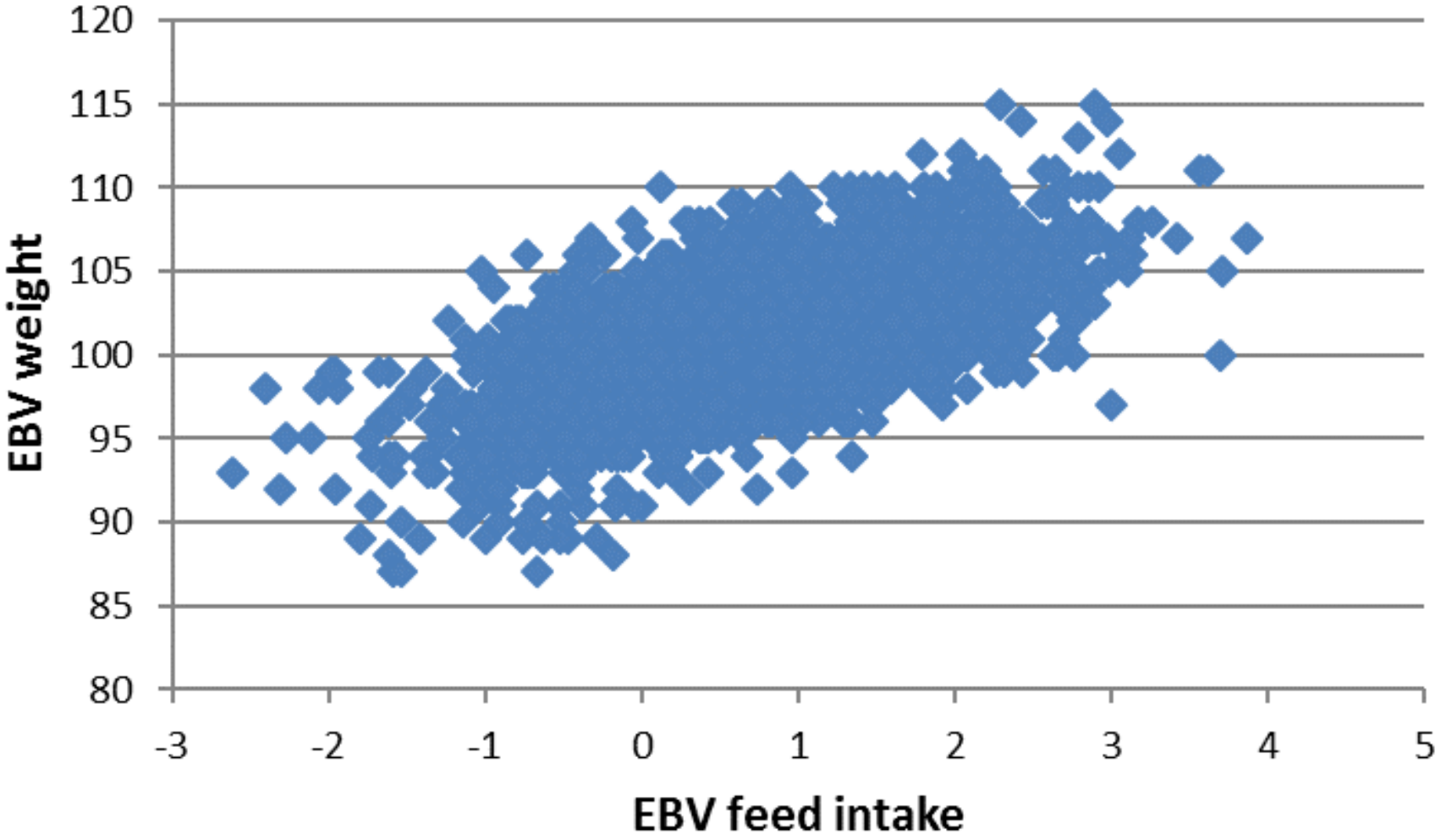
3. Model routine evaluation

4. Compute EBVs using:
   direct DMI
   genomic prediction
   indicators milkproduction traits and body weight

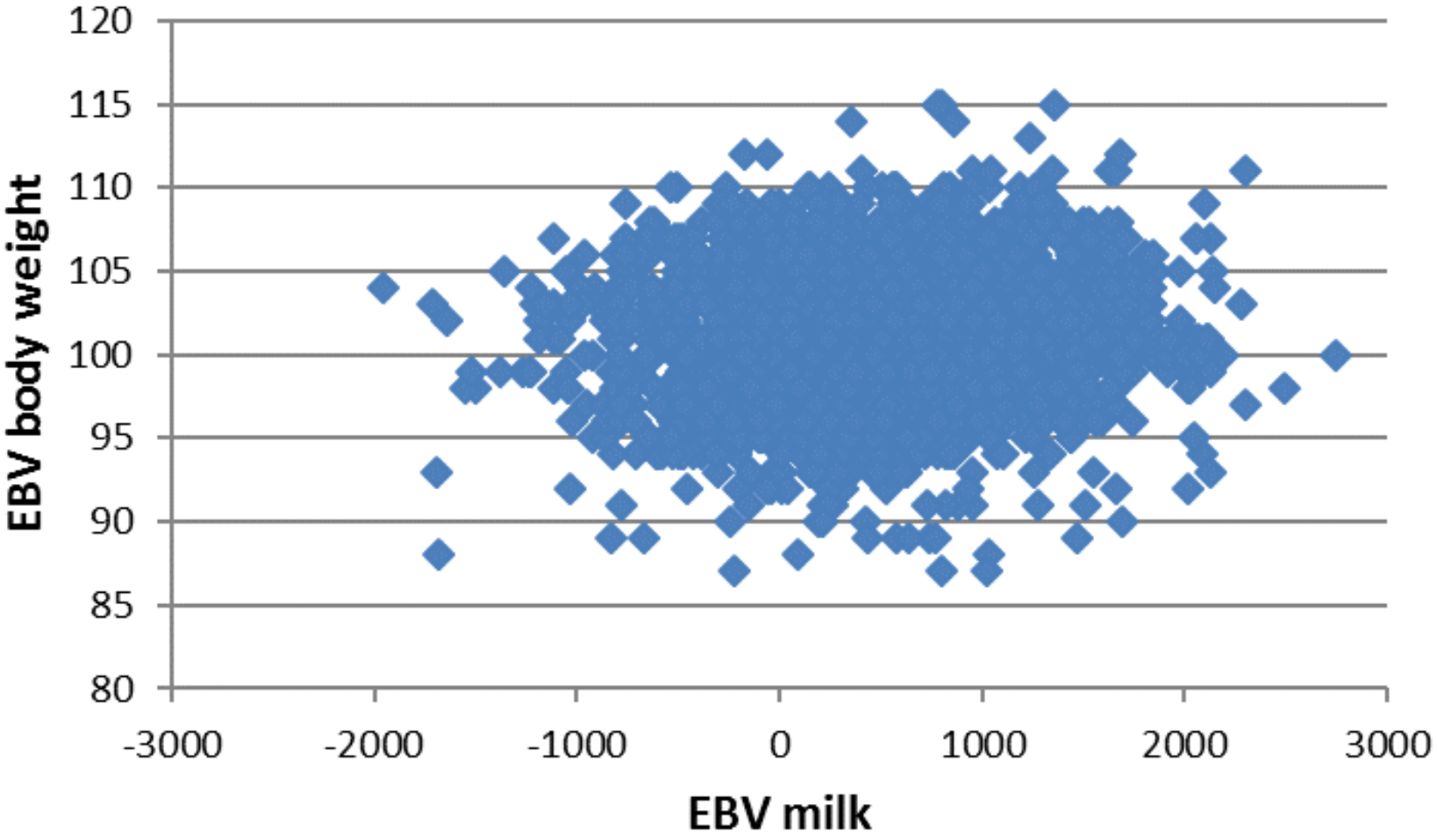
Milk versus dry matter intake



Body weight vs dry matter intake



Milk versus body weight



Results on bulls - Holstein

based on genomics and indicators

year of birth	number	rel dmi	ebv dmi	ebv milk	ebv fat	ebv prot	ebv lactose	ebv body weight
2006	444	60	0.11	239	-1	2	13	0.4
2007	324	58	0.22	294	1	4	15	0.2
2008	340	59	0.55	409	10	9	19	6.6
2009	345	56	0.60	448	12	9	21	6.3
2010	343	56	0.94	478	17	13	23	14.2
2011	264	54	1.12	674	22	18	33	11.7
2012	233	54	1.34	628	29	20	31	14.8
2013	171	54	1.59	887	34	26	42	15.8

Reliability based on predictors and genomics
-> maximum determined by correlation of predictors with dmi

Extra direct information dmi

only genomic information

Birth year	Number bulls with extra dmi info	Average effect extra dmi info	Average effect reliability extra dmi info	Stdev effect extra dmi info
2006	224	-0.02	5	0.17
2007	158	0.03	5	0.17
2008	162	-0.01	5	0.19
2009	106	-0.05	5	0.18
2010	142	0.00	4	0.17
2011	132	-0.10	5	0.17
2012	127	-0.01	5	0.16
2013	110	-0.10	4	0.16

0.17 is about 12% of genetic stdev

Breeding goal

- Current Inet:

  $Inet_{2015}$ = 0.3 lactose + 2.1 fat + 4.1 protein

  weights milk components = price paid by factory – feed cost

- Inet with dmi*:

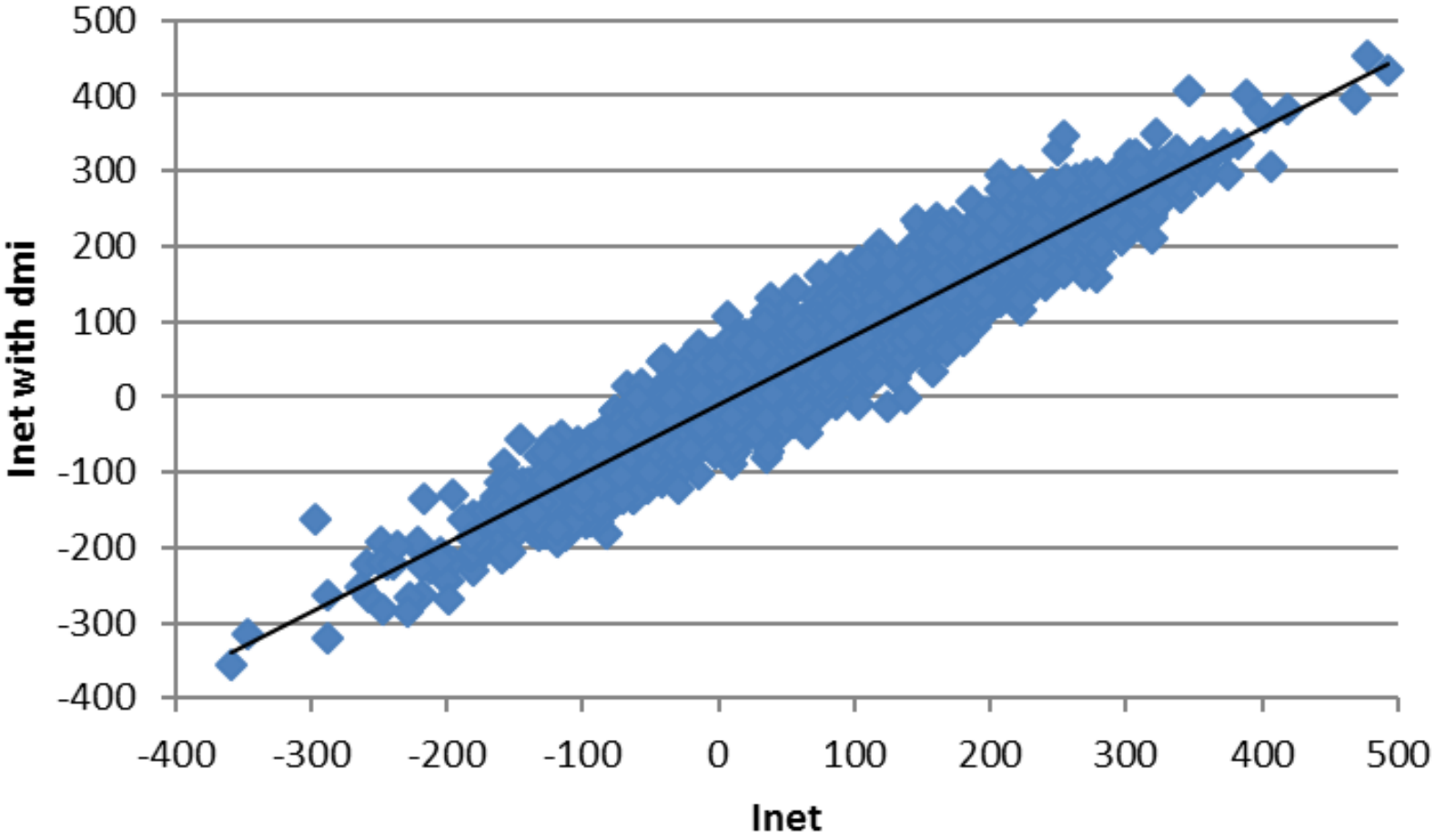
  $Inet_{2017}$ = 0.5 lactose + 2.7 fat + 5.4 protein – 60.2 kg dmi

  weights milk components = price paid by factory
  weight dmi = cost feed (energy)

  $Inet_{2017}$ direct relationship with maintenance (size/efficiency of cow)

* Production EBV = kg/305 days
  dmi EBV = kg /day

Inet vs Inet with dry matter intake



correlation 0.95

spread difference 36 euro -> 30% of genetic st.dev.

Effect on selection: Inet part of Dutch-Flemish NVI

top 100 NVI – top 100 NVI (incl DMI)

	respons in % gen. stdev	
feed intake	-14%	Net +2% in Euro
protein	-4%	
fat	-6%	
lactose	-5%	
body weight	-21%	Less maintenance
stature	-17%	
longevity	5%	No neg. effect on health
udder health	-1%	
fertility	2%	

Summary

- Dry matter intake EBVs available, based on
  - 3200 cows and indicators
  - genomic prediction available

- DMI part of breeding goal: Inet and NVI
  - 2 percent more efficient
  - no effect on health

- More data collected coming years
  - Increase of reliability genomic predition

- End result: more efficient cow