25 Years

KU LEUVEN

EUROPEAN PIG PRODUCERS

Speaker 1:Nadine Buys

Thursday, 4th june 2015

Subject 1: Selection against boar taint as sustainable alternative to piglet castration

Thursday, 4th june 2015

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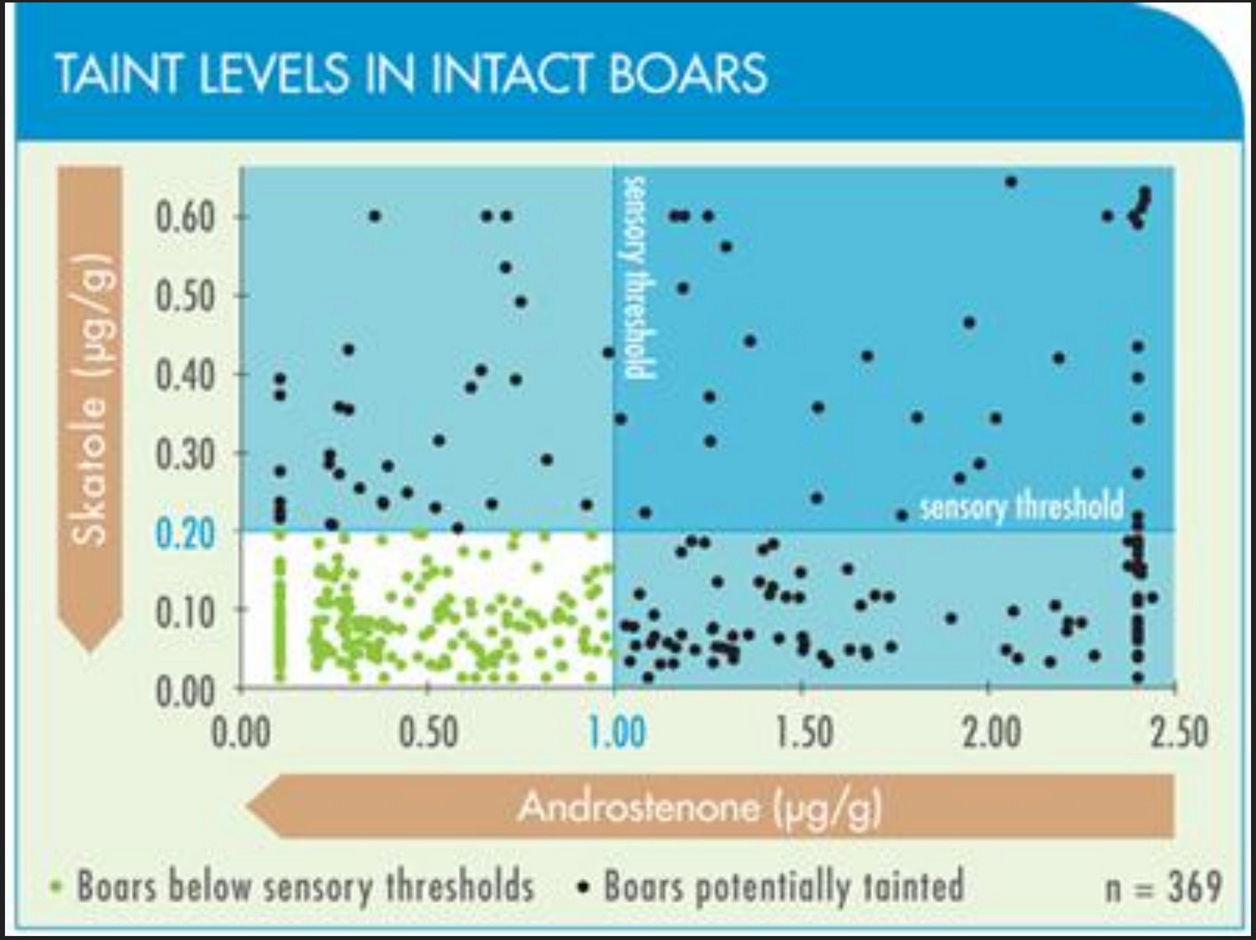
Boar taint: background

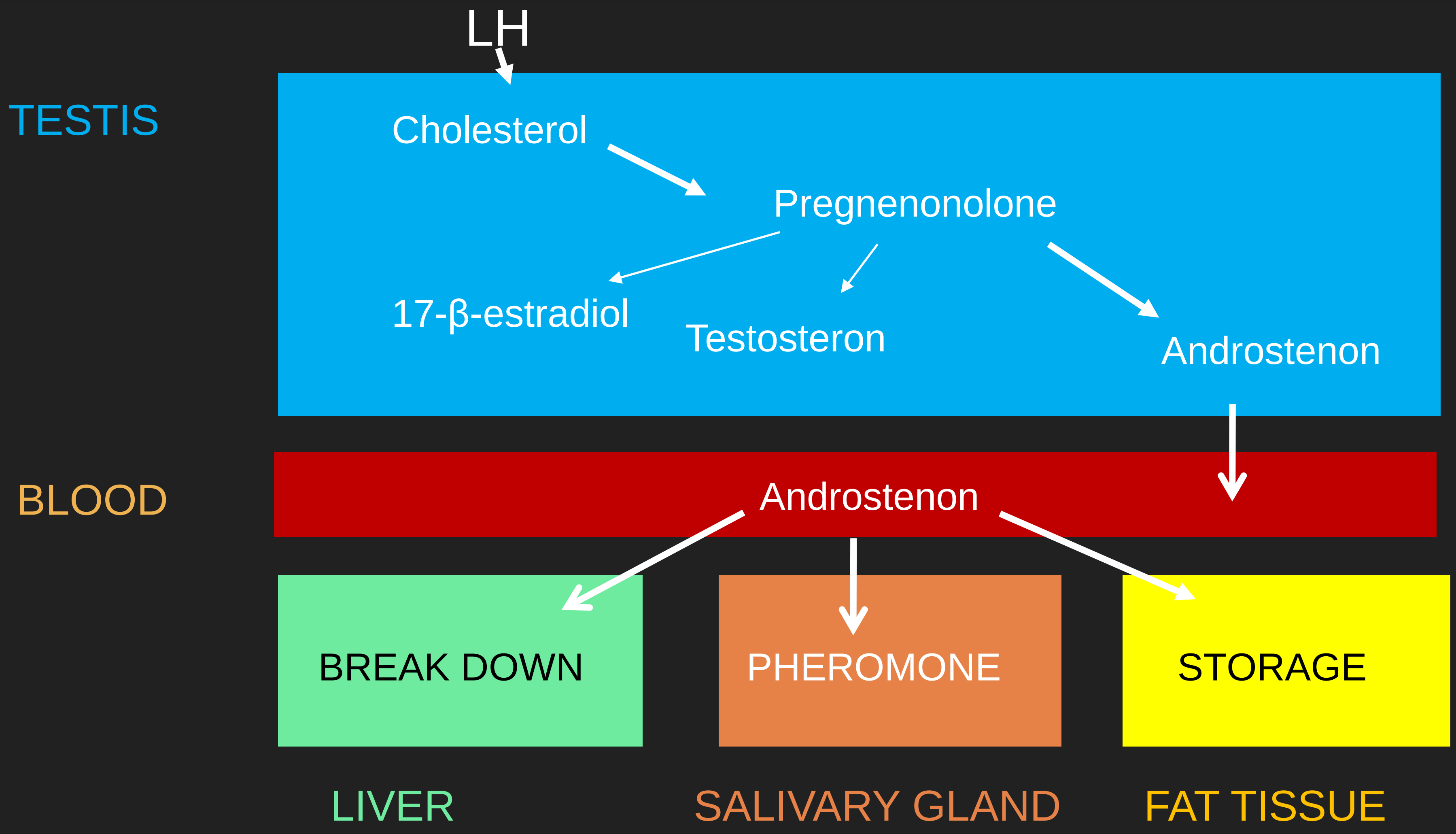
- offensive odour or taste that is often evident during the cooking or eating pork derived from non-castrated male pigs once they reach puberty.
- 5-8 % of boar pigs (≤ 110 kg) show boar taint
- 10 - 25% of consumers cannot smell or taste the taint chemicals

Boar taint is caused by compounds that accumulate in fat as male pigs become sexually active

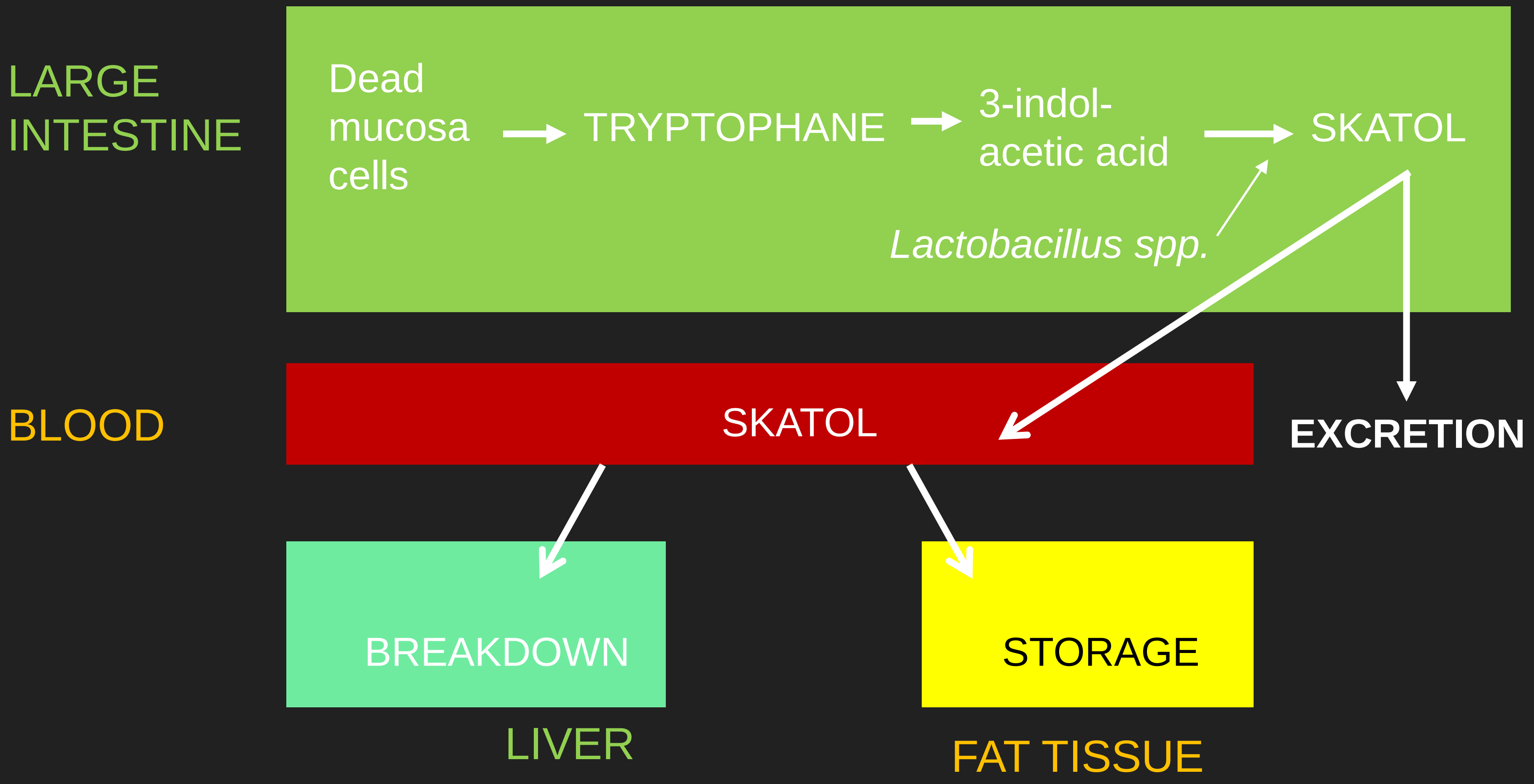
- androstenone, a male pheromone produced in the testes
- skatole, a by-product of bacterial activity in the gut
- Androstenol
- Indol
- 4-phenyl-3-buten-2-one



Androstenon



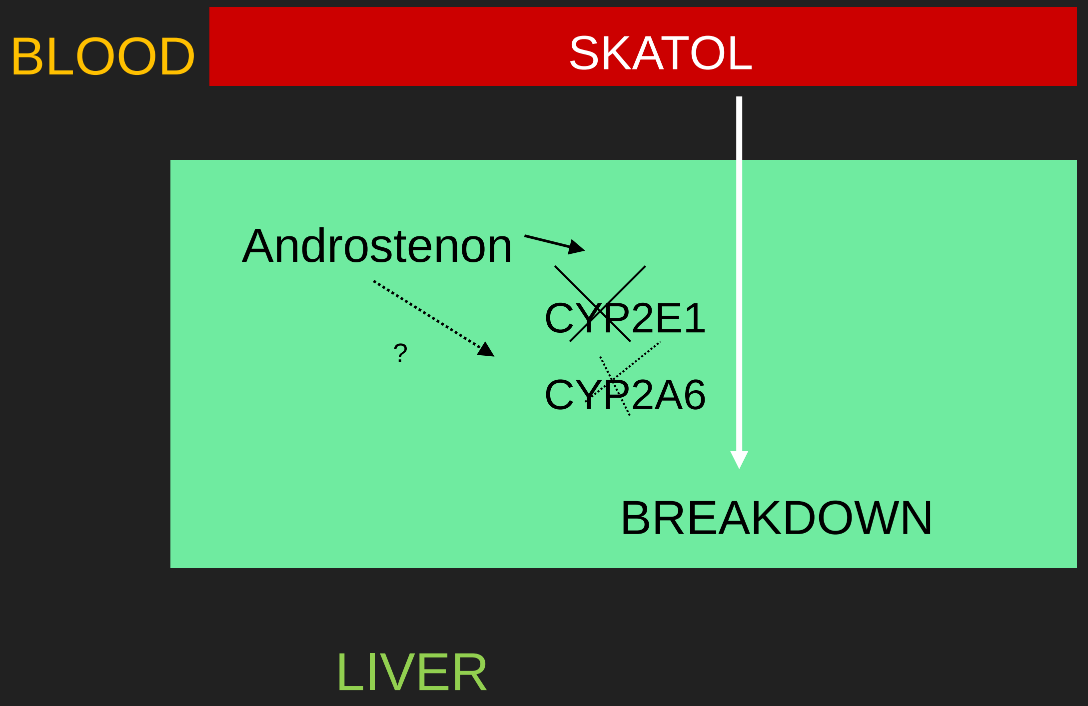
Skatol


LARGE INTESTINE
Dead mucosa cells
TRYPTOPHANE
3-indol-acetic acid
SKATOL
Lactobacillus spp.
BLOOD
SKATOL
EXCRETION
BREAKDOWN
LIVER
STORAGE
FAT TISSUE

Skatol in male pigs

- the breakdown of skatole absorbed into the body is inhibited by testosterone and androstenone

- so it also tends to accumulate in male pigs as the testes start to produce more testosterone at puberty



Castration

- about 95% of male pigs are castrated as piglets
- surgically, non anesthesised
- First days or weeks after birth (2-7 weeks)
- painful and highly aversive to pigs => significant welfare concern

drawbacks:

- Production losses due to infection, injury and herniation
- Reduced feed conversion compared to intact boars
- Carcass is less lean and more fat compared to intact boars
- Pain and stress for the animal

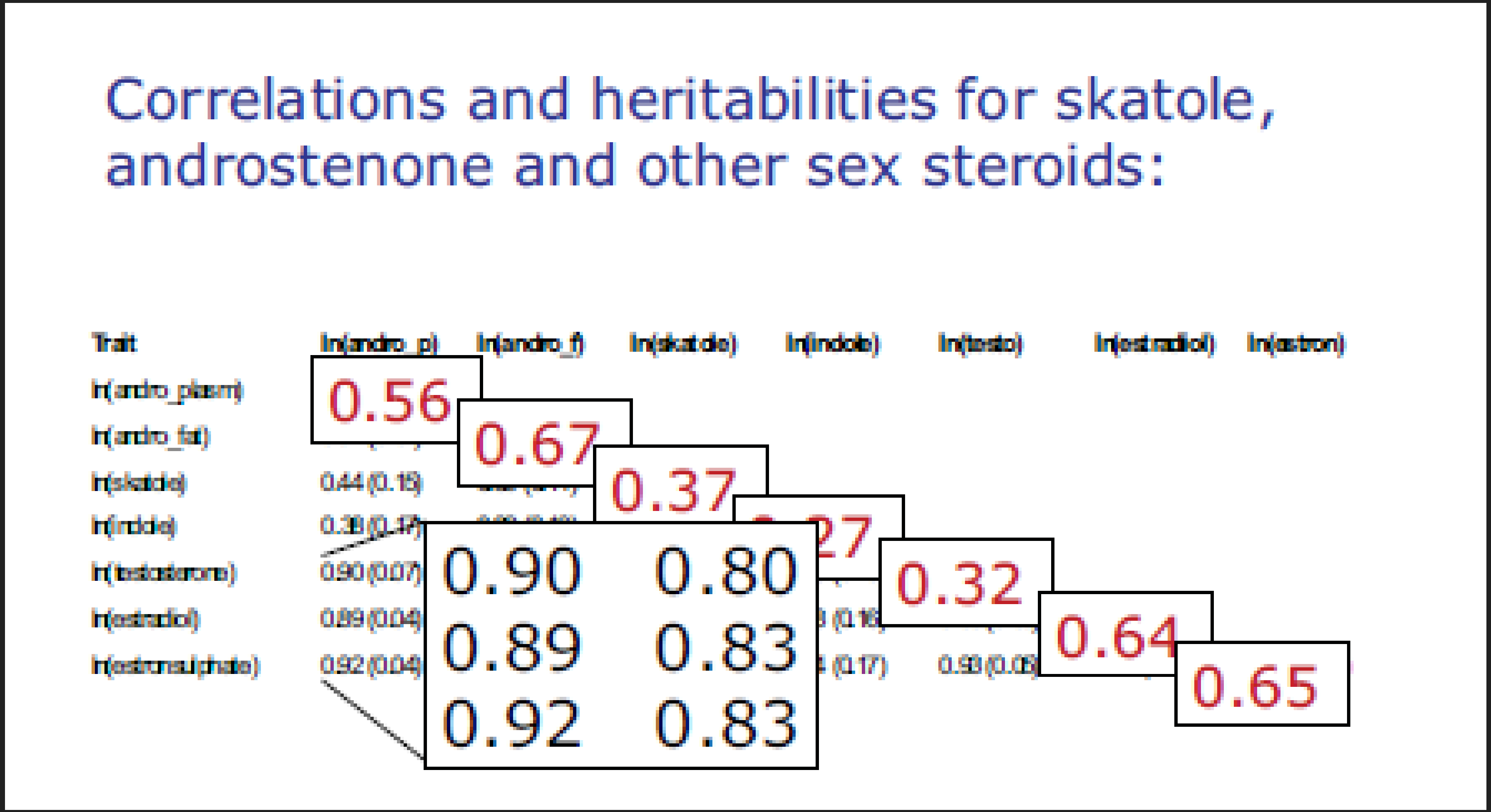
Alternatives?

- Surgical castration with anesthesia (local / general) and/or analgesics
- Reduced slaughter weight
- Environmental factors
- Immunocastration
- Sexing semen
- Detection of boar taint in the slaughter line
- Genetic selection: breeding low taint pigs

Breeding

- Highly positive correlations between androstenone and orher sex steroids

- Grindflek ea, 2009)



Genome scan

Breeding boars to smell well. KU Leuven and ILVO identify a gene linked with lower risk for boar taint

Selecting for pigs with a lower genetic predisposition to produce boar taint could be a big leap forwards for producing male pigs without surgical castration. In an ILVO-KU Leuven study, a marker gene for boar taint was identified. Pigs selected against boar taint showed fewer boar taint compounds in blood and fat, better slaughter quality and a higher meat percentage.

Detection of quantitative trait loci for androstenone, skatole and boar taint in a cross between Large White and Meishan pigs

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Duijvesteijn *et al. BMC Genetics* 2010, **11**:42
http://www.biomedcentral.com/1471-2156/11/42
BMC Genetics
RESEARCH ARTICLE Open Access

A genome-wide association study on androstenone levels in pigs reveals a cluster of candidate genes on chromosome 6

Naomi Duijvesteijn*[1], Egbert F Knol[1], Jan WM Merks[1], Richard PMA Crooijmans[2], Martien AM Groenen[2], Henk Bovenhuis[2] and Barbara Harlizius[1]

Conclusions: This study reveals several areas of the genome at high resolution responsible for variation of androstenone levels in intact boars. Major genetic factors on SSC1 and SSC6 showing moderate to large effects on androstenone concentration were identified in this commercial breeding line of pigs. Known and new candidate genes cluster especially on SSC6. For one of the most significant SNP variants, the difference in the proportion of animals surpassing the threshold of consumer acceptance between the two homozygous genotypes was as much as 15.6%.

Comparison of breeding strategies

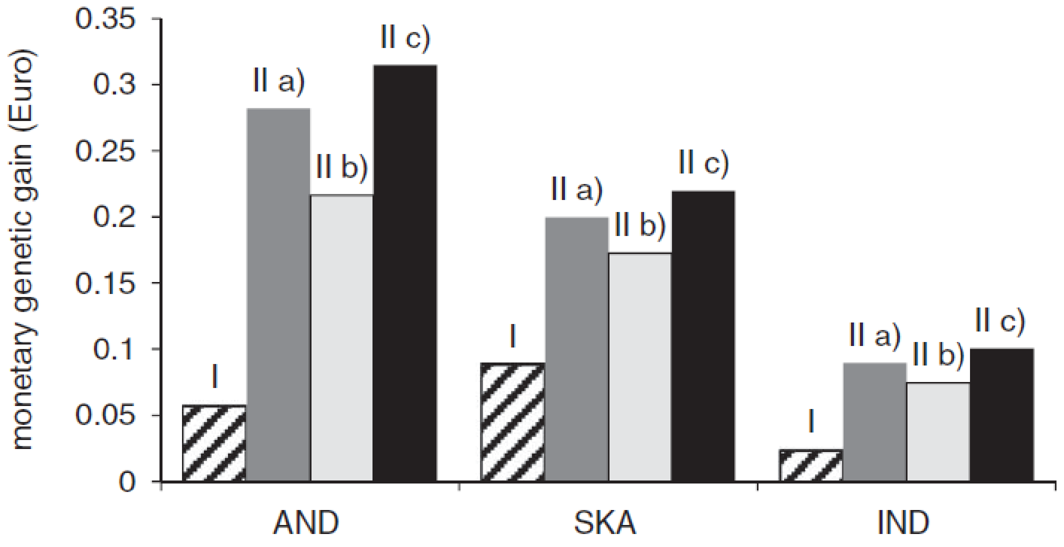

Figure 1 Annual genetic gain of boar taint compound androstenone (AND), skatole (SKA) and indole (IND) for different information sources: scenario I (hatched); scenario II with biopsy-based performance testing (dark gray); genomic selection (GS, light gray); and a combination of biopsy and genomic selection (black).

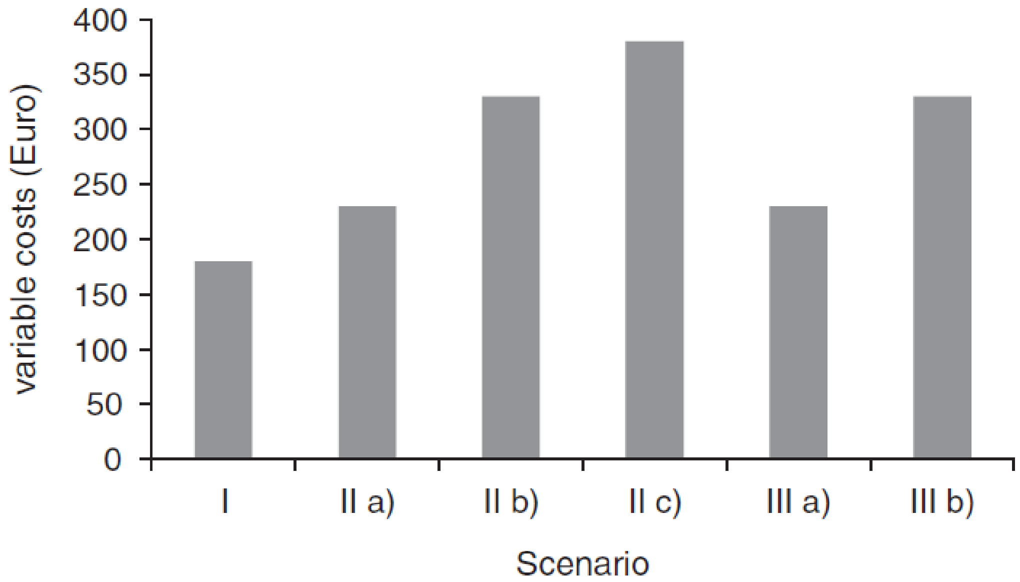

Figure 2 Variable costs in Euro for the reference scenario (I), selection against boar taint compounds via biopsy-based performance testing (II a)), genomic selection (II b)) or both (II c)), as well as for the selection against the human nose score via test individuals (III a)) or genomic selection (III b)).

Selection strategies

Animal (2014), **8:1**, pp 11–19 © The Animal Consortium 2013
doi:10.1017/S1751731113001857

Efficiency of different selection strategies against boar taint in pigs

A. M. Haberland[1†], H. Luther[2], A. Hofer[2], E. Tholen[3], H. Simianer[1], B. Lind[4] and C. Baes[2,5]

- Biopsy based performance testing
  and human nose scoring
  are effective for selection against Androstenone, skatol and Indol
- Average amount could be reduced by 50% within 6 to 8 years
- Caution owing to possible negative effects on drip loss, average daily gain, intra muscular fat and fertility traits

selection

Genetic relationship between boar taint compounds, human nose scores, and reproduction traits in pigs[1]

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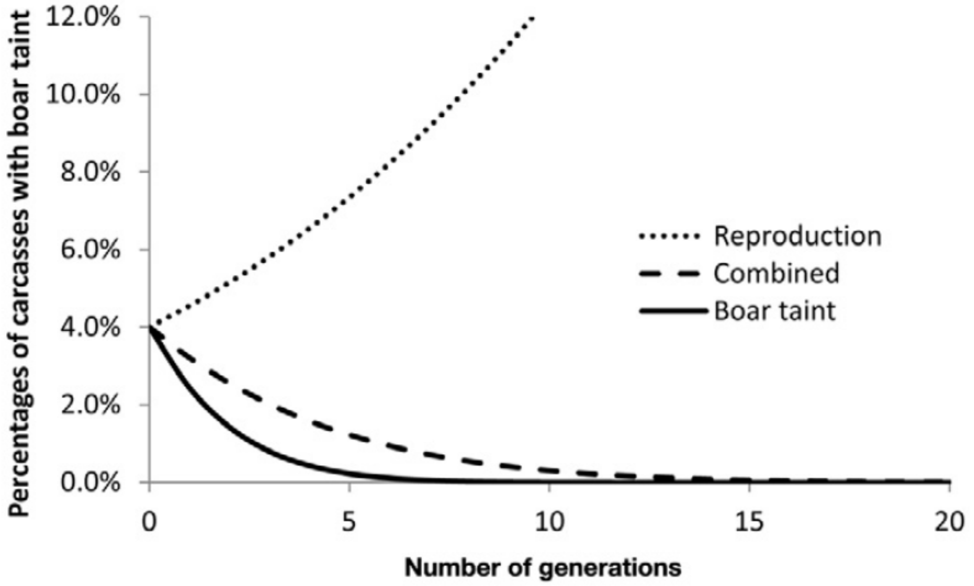

Figure 2. Expected cumulative genetic change in percentage of carcasses with boar taint from genetic selection on boar taint traits only, female reproduction traits only, and a combination of boar taint and female reproduction traits.

Table 4. Number of pigs analyzed (n), mean and SD of boar taint compounds

Line	n boars	Androstenone Log µg/g Mean	Androstenone Log µg/g SD	Skatole Log ng/g Mean	Skatole Log ng/g SD	Indole Log ng/g Mean	Indole Log ng/g SD
Pietrain	641	–1.16	0.97	3.99	0.83	3.20	0.73
Landrace	920	–0.02	0.86	5.16	0.89	3.93	0.80
Yorkshire	335	0.22	1.07	4.72	1.06	3.78	1.00

Table 5. Human nose scores in different lines

Line	n boars	n tests	Frequency of human nose scores (%) 0	1	2	3	4
Pietrain	1,014	3,070	78.5	11.5	5.8	3.0	1.2
Landrace	1,145	3,504	52.0	15.3	13.7	12.2	6.7
Yorkshire	401	1,168	53.9	15.6	11.9	10.3	8.4

Conclusion

- Combined selection for fertility and boar taint
- Focus on dam lines
- Biopsy and human nose