G19.6

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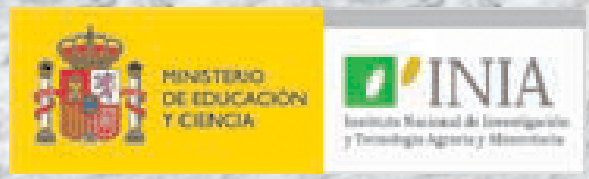
CONTROL OF THE COANCESTRY IN BREEDING PROGRAMS FOR AQUACULTURE SPECIES

Fernández, J., Vega, L., Toro, M. A.

Departamento de Mejora Genética Animal. Instituto Nacional de Investigación y Tecnología Agraria y Alimentaria. Madrid.



$$R = \rho_A \, i/L \, \sigma_A$$

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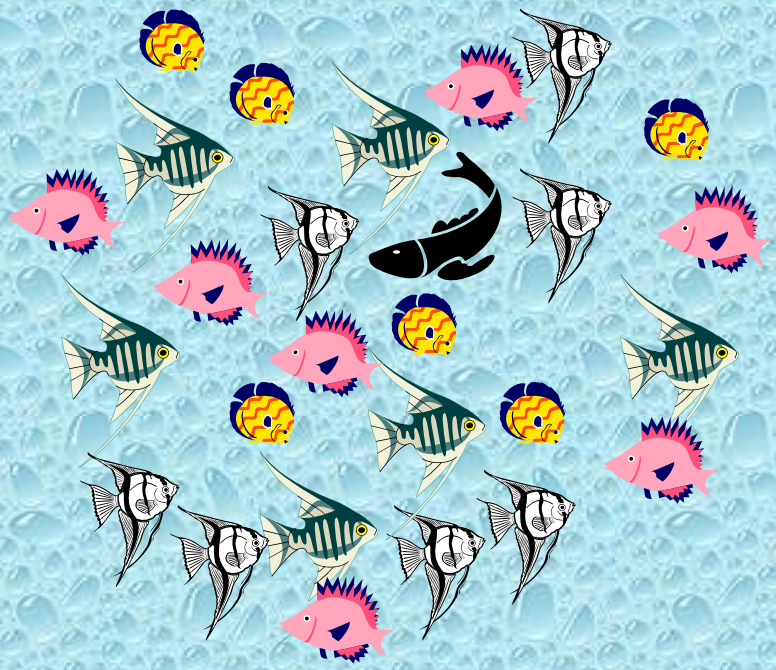
✓ **higher selection pressure**

$R = \rho_A \, i/L \, \sigma_A$

✓ **use of relatives' information**

AQUACULTURE



High reproductive rate

DISADVANTAGE

⇒ rise of inbreeding

⇒ loss of diversity

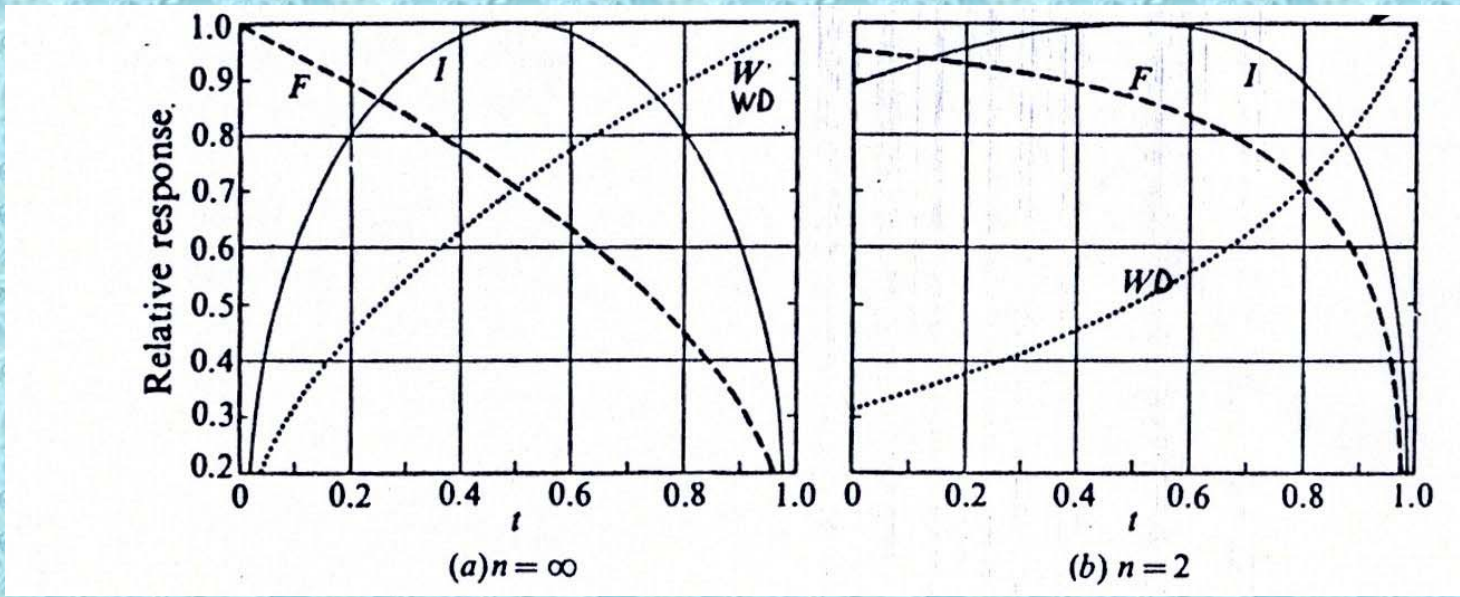
long-term response

new selection objective

Influence of relative's information

$$R_f = ih\sigma_A \frac{1+r(n-1)}{\sqrt{n[1+t(n-1)]}}$$

$$R_w = ih\sigma_A (1-r)\sqrt{\frac{n-1}{n(1-t)}}$$



Influence of relative's information

balance/compromise response - inbreeding?

METHODS

- ✓ **quantitative trait ⇒ infinitesimal model ($\mu = 50$ $\sigma^2_P = 100$)**
- ✓ **different combinations of h^2 *and* c^2**
- ✓ **two scenarios:**

FS

$M = F = 25$

$N = 100$ indiv. per family

HS

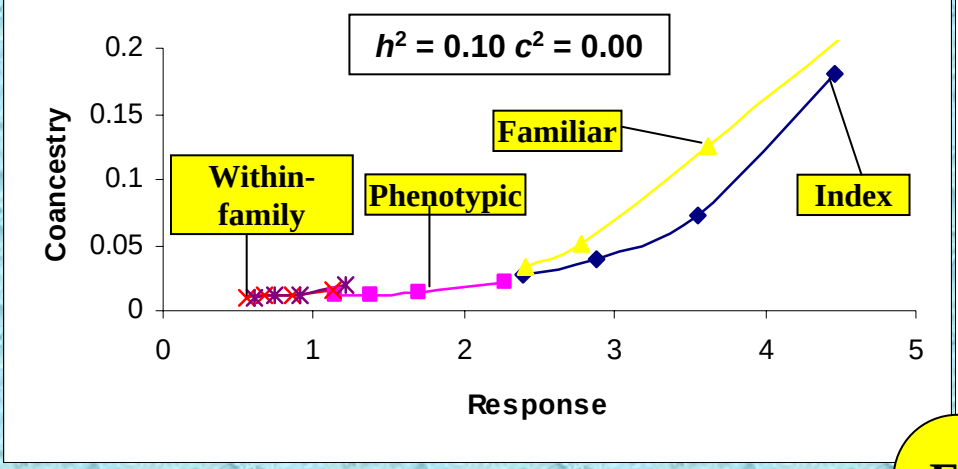
$M = 10$ $F = 50$

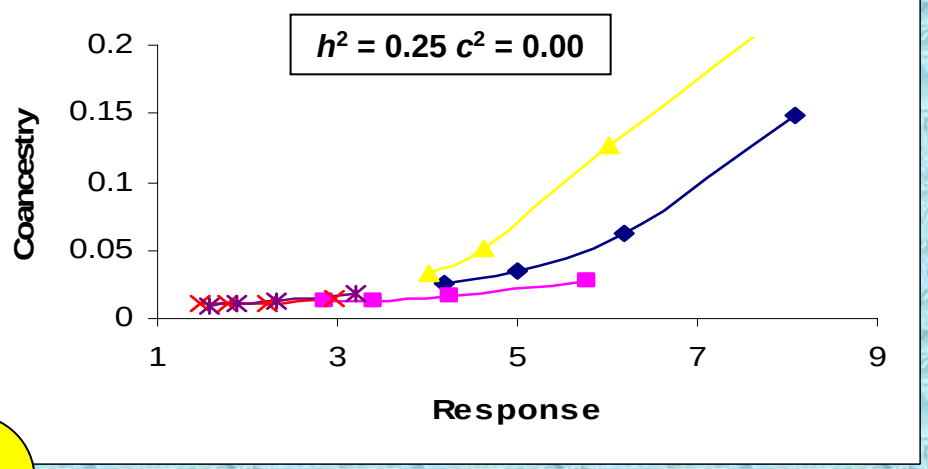
5 females per male

$N = 100$ indiv. per family

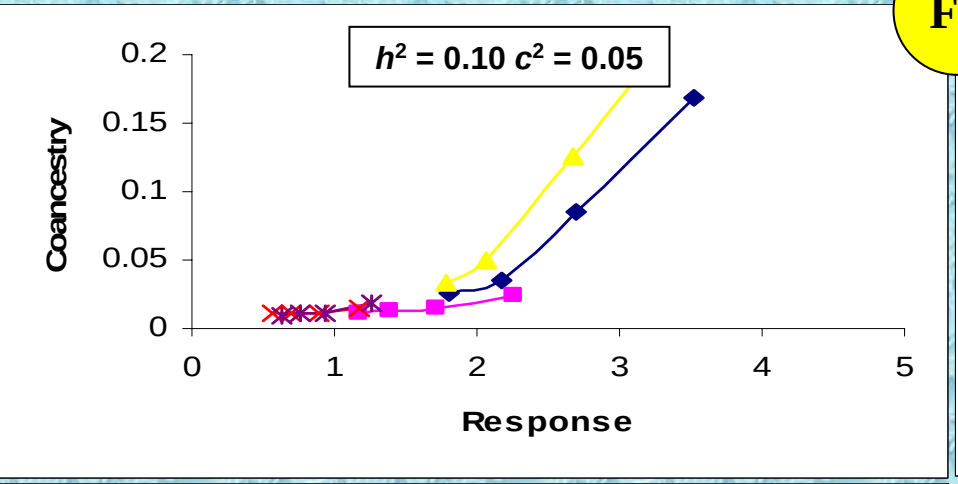
- ✓ **selection ⇒ phenotype, within-family, familiar and index**

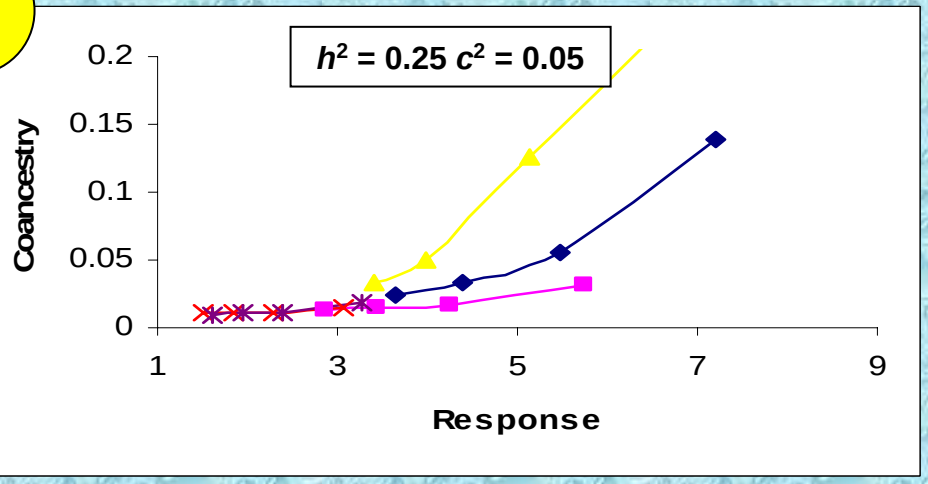
$$I = b_1 P_{y-\bar{y}_{FS}} + b_2 P_{\bar{y}_{FS}-\bar{y}_{HS}} + b_3 P_{\bar{y}_{HS}}$$ ⇒ **equivalent to BLUP**


h^2 = 0.10 c^2 = 0.00
Familiar
Within-family
Phenotypic
Index
Coancestry
Response
0.2
0.15
0.1
0.05
0
0
1
2
3
4
5


h^2 = 0.25 c^2 = 0.00
Coancestry
Response
0.2
0.15
0.1
0.05
0
1
3
5
7
9

FS


h^2 = 0.10 c^2 = 0.05
Coancestry
Response
0.2
0.15
0.1
0.05
0
0
1
2
3
4
5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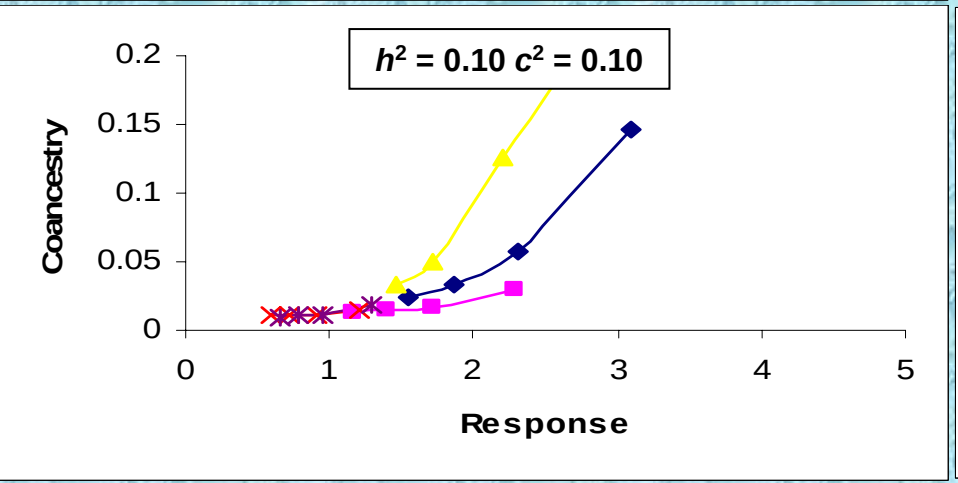
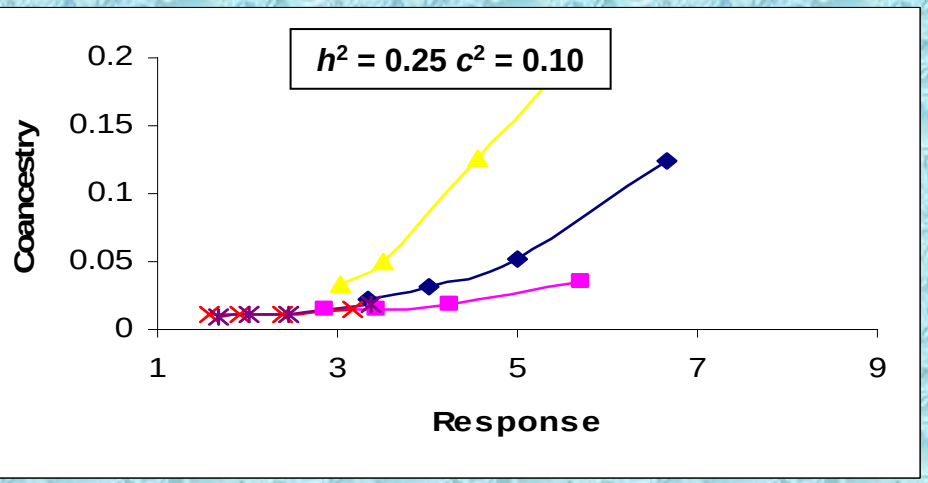
Coancestry
Response
0.2
0.15
0.1
0.05
0
1
3
5
7
9


h^2 = 0.10 c^2 = 0.10
Coancestry
Response
0.2
0.15
0.1
0.05
0
0
1
2
3
4
5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Coancestry
Response
0.2
0.15
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0
1
3
5
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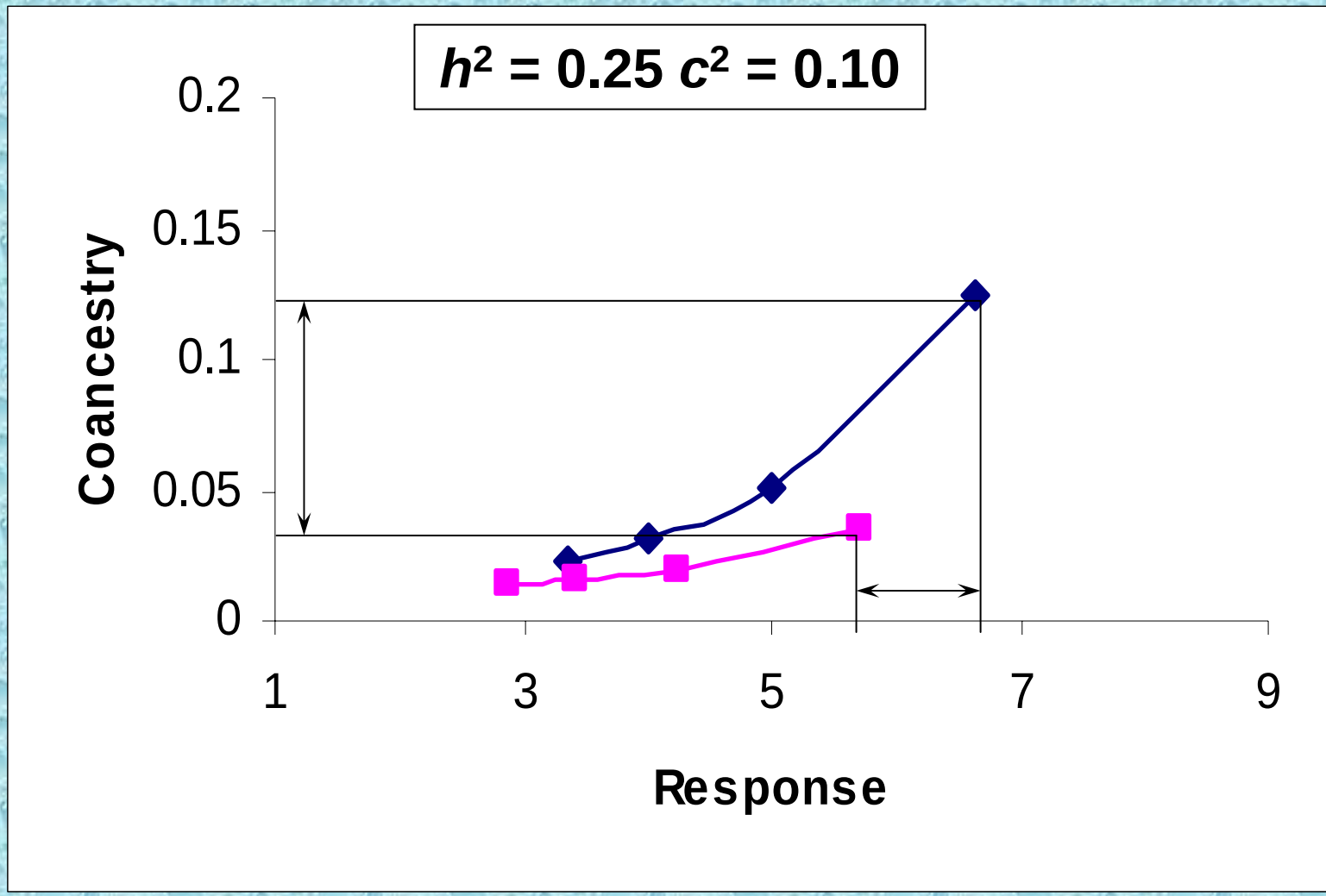
9



$t \approx 0.5$ $R_P = R_I$

$t = 0.35$

			Response		Coancestry of selected	
	h^2	c^2	Index	Phenotypic	Index	Phenotypic
FS	0,10	0	4,46	2,27	0,18	0,02
		0,05	3,51	2,27	0,17	0,03
		0,10	3,09	2,28	0,15	0,03
	0,25	0	8,07	5,76	0,15	0,03
		0,05	7,21	5,74	0,14	0,03
		0,10	6,65	5,72	0,13	0,04
HS	0,10	0	4,16	2,35	0,14	0,03
		0,05	3,42	2,33	0,13	0,03
		0,10	3,13	2,31	0,13	0,04
	0,25	0	7,57	5,78	0,13	0,04
		0,05	6,92	5,78	0,12	0,04
		0,10	6,55	5,77	0,11	0,04

HOW TO COPE WITH INBREEDING?

- ✓ modification of the number of selected individuals and their contributions

- ✓ selection of non “elite” individuals

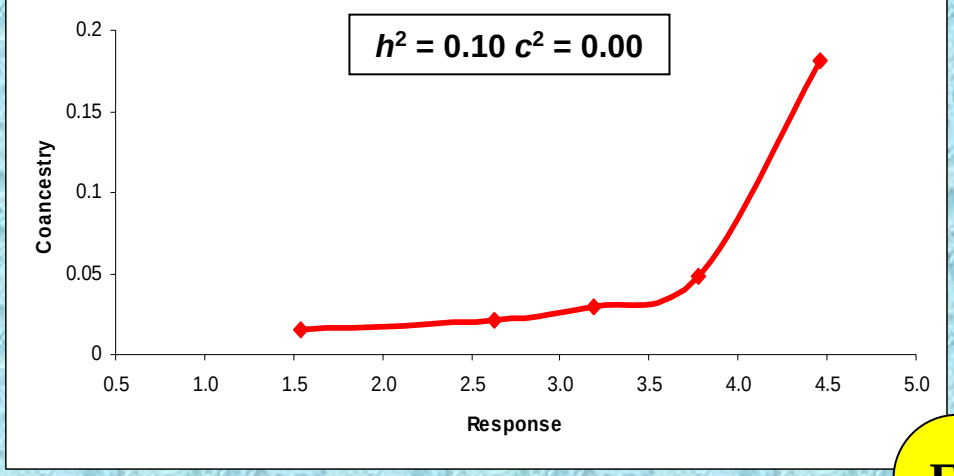
$$\max \sum_{i=1}^{NF} EBV_i \cdot x_i - \lambda \left(\sum_{i=1}^{NF} \sum_{j=1}^{NF} x_i x_j f_{ij} \right)$$

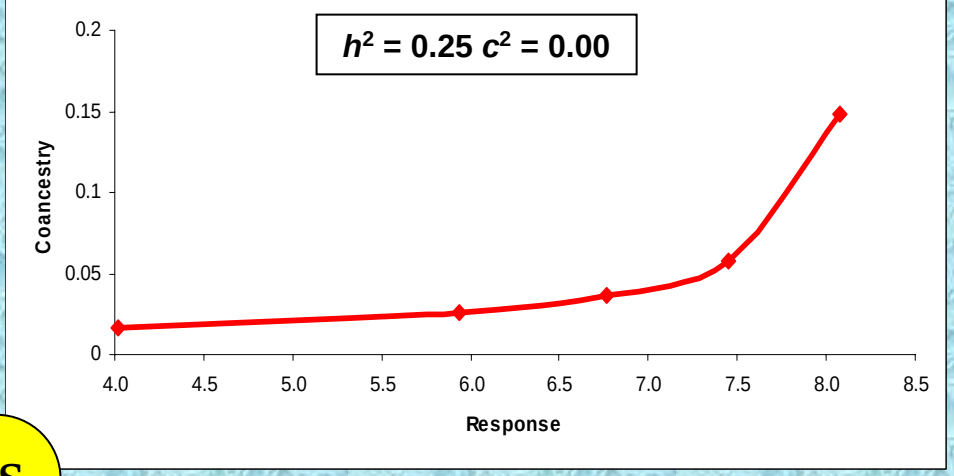
$$\boxed{\overline{EBV} - \lambda \bar{f}}$$

solved by "simulated annealing"

$\Rightarrow \lambda = 0$ **: truncation selection**

$\Rightarrow \lambda \uparrow\uparrow$ **: only interested on inbreeding**


$h^2 = 0.10\ c^2 = 0.00$
Coancestry
0.2
0.15
0.1
0.05
0
0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0
Response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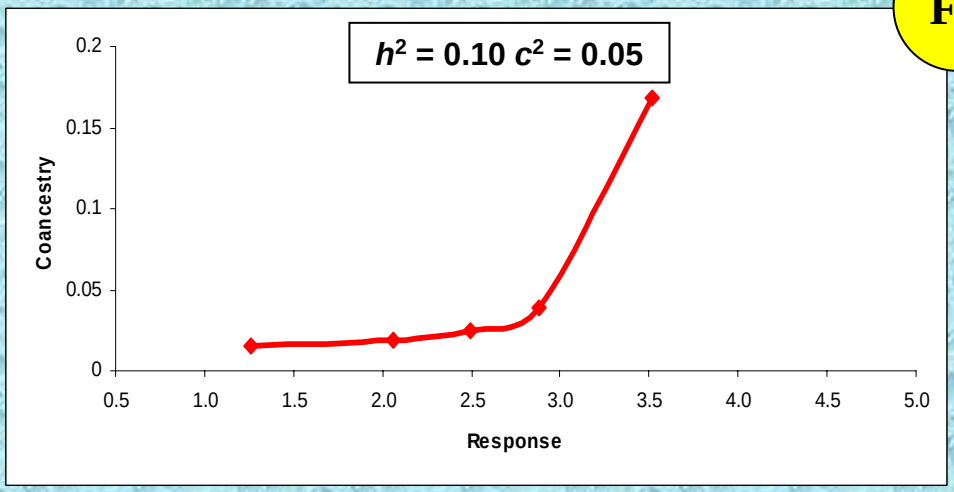
Coancestry
0.2
0.15
0.1
0.05
0
4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5 8.0 8.5
Response

FS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Coancestry
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0.15
0.1
0.05
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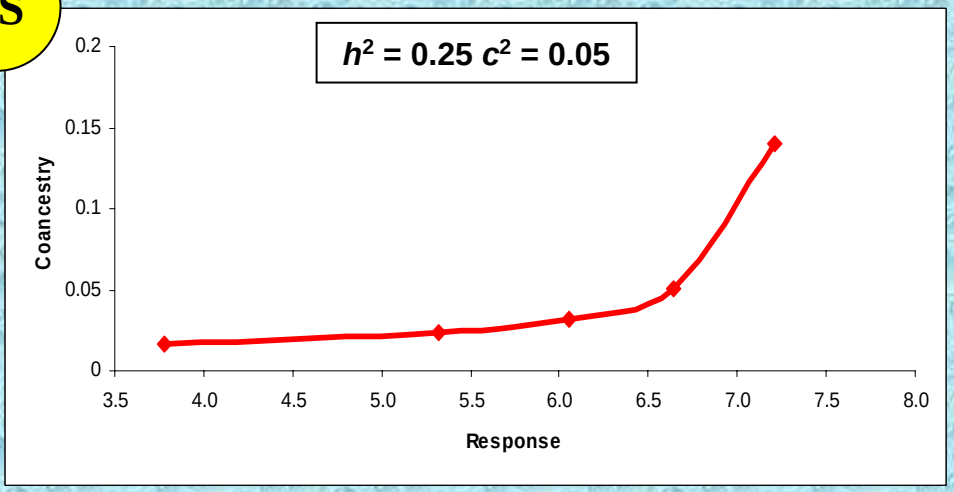
0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0
Response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Coancestry
0.2
0.15
0.1
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3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5 8.0
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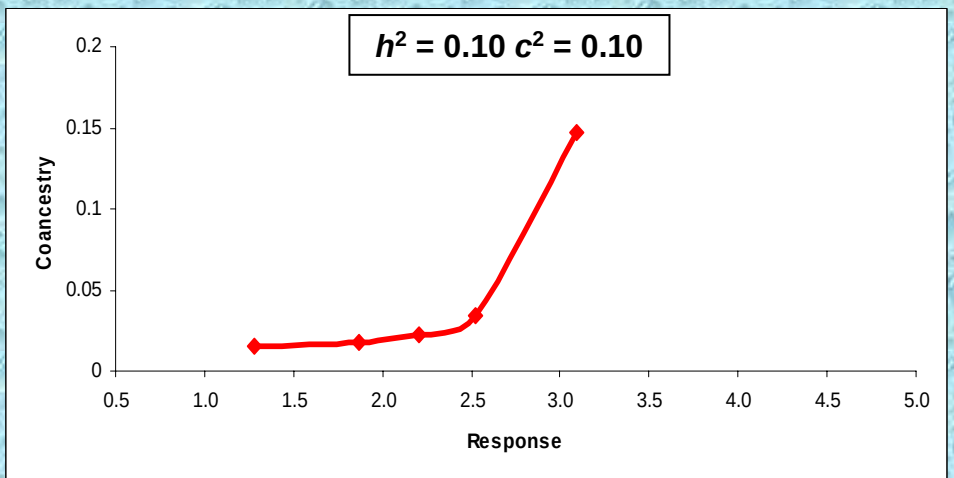
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Coancestry
0.2
0.15
0.1
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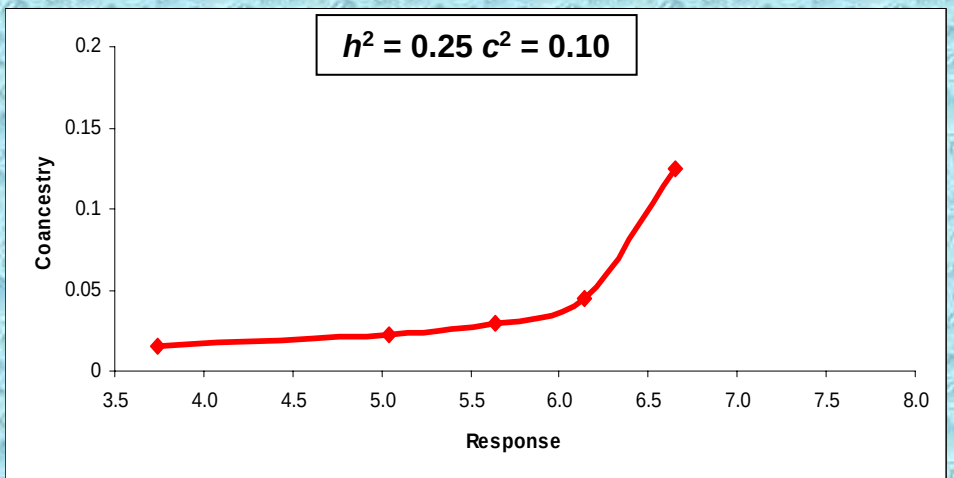
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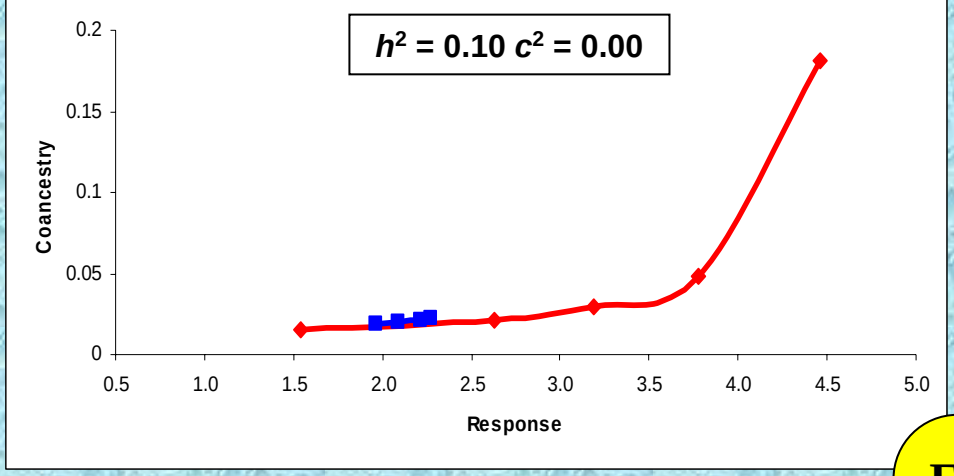
Coancestry
0.2
0.15
0.1
0.05
0
3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5 8.0
Response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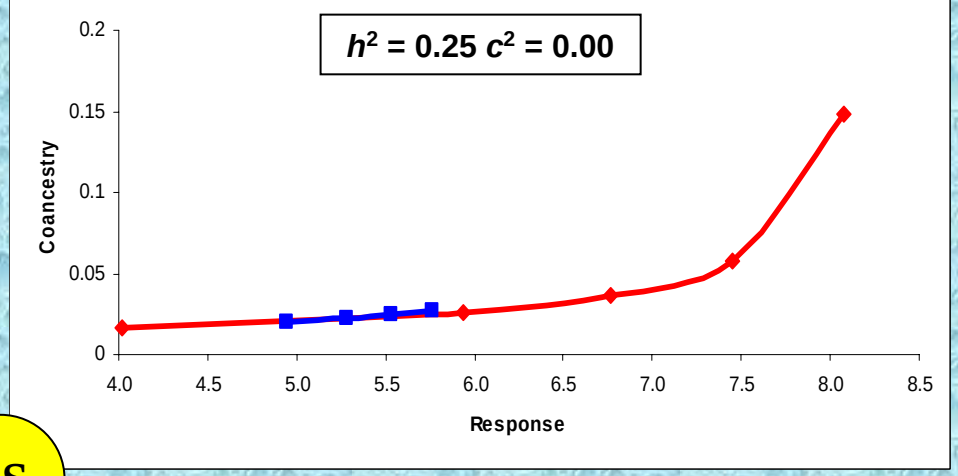
Coancestry
Response
0
0.05
0.1
0.15
0.2
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0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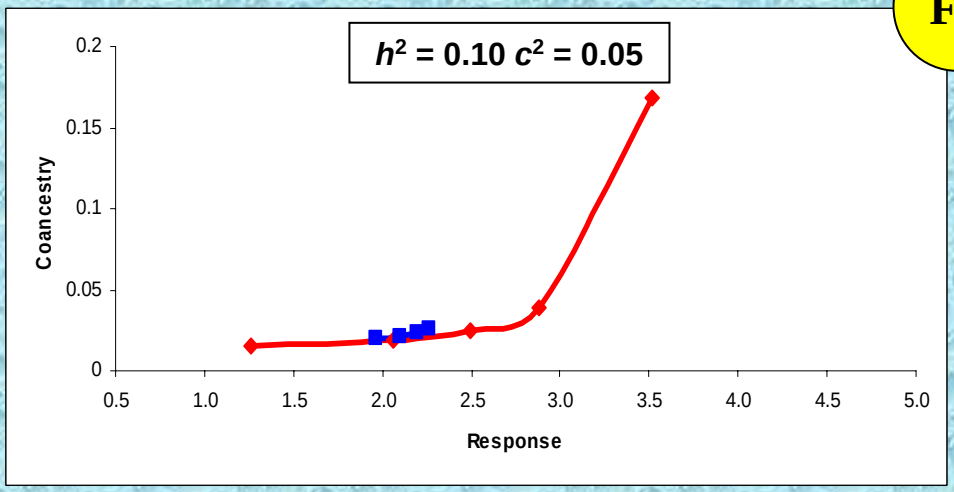
Coancestry
Response
0
0.05
0.1
0.15
0.2
4.0
4.5
5.0
5.5
6.0
6.5
7.0
7.5
8.0
8.5

FS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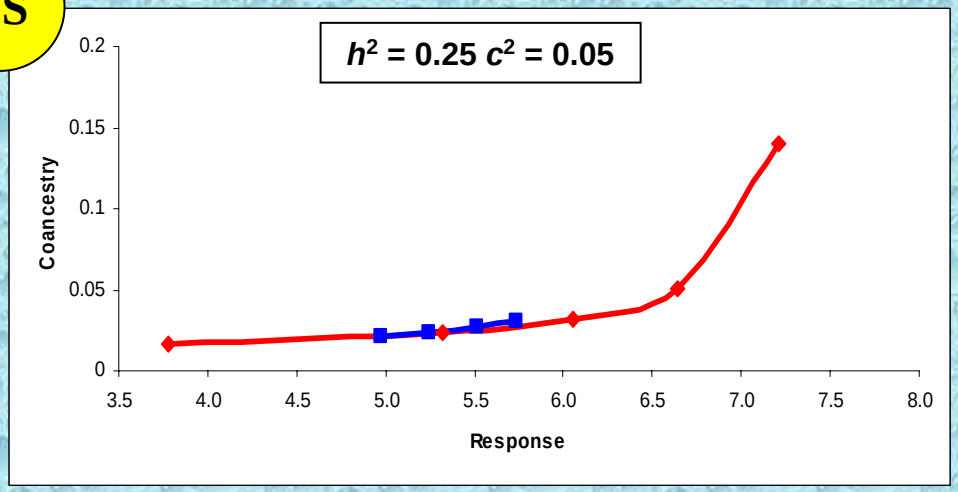
Coancestry
Response
0
0.05
0.1
0.15
0.2
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0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Coancestry
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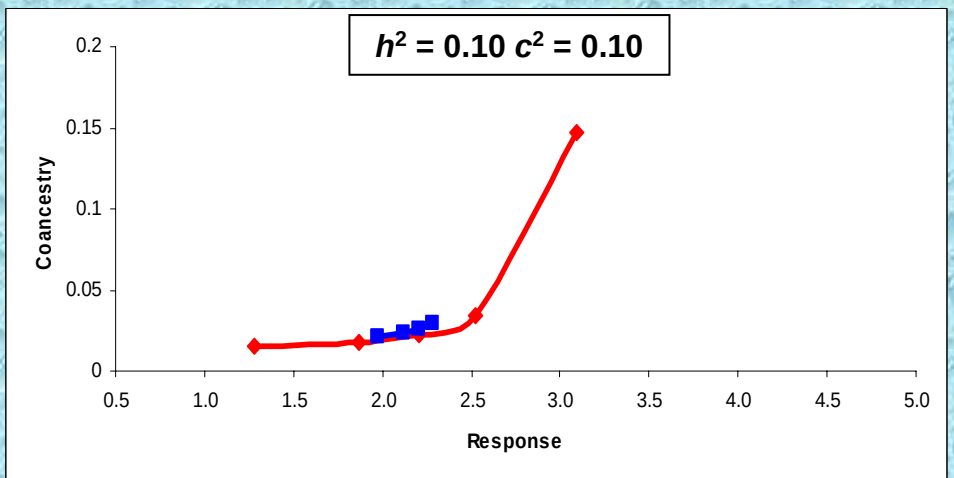
0
0.05
0.1
0.15
0.2
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
7.5
8.0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Coancestry
Response
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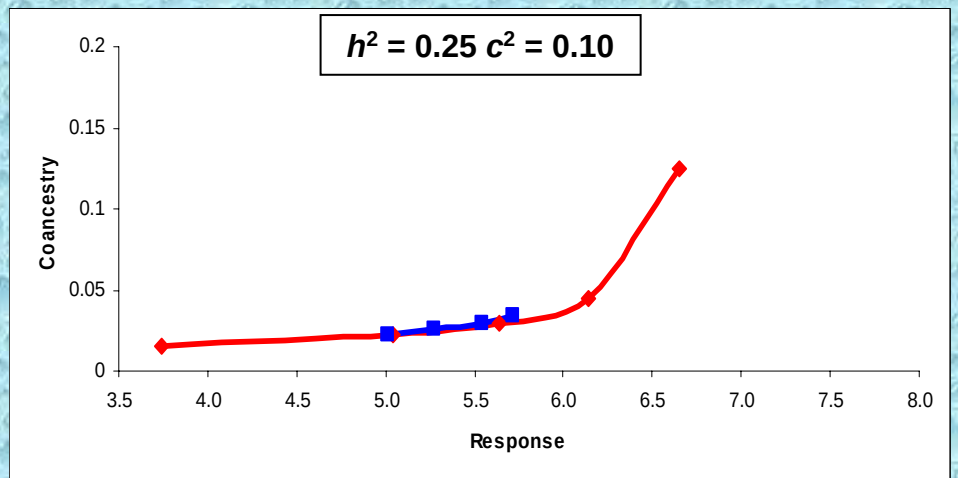
0.05
0.1
0.15
0.2
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0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Coancestry
Response
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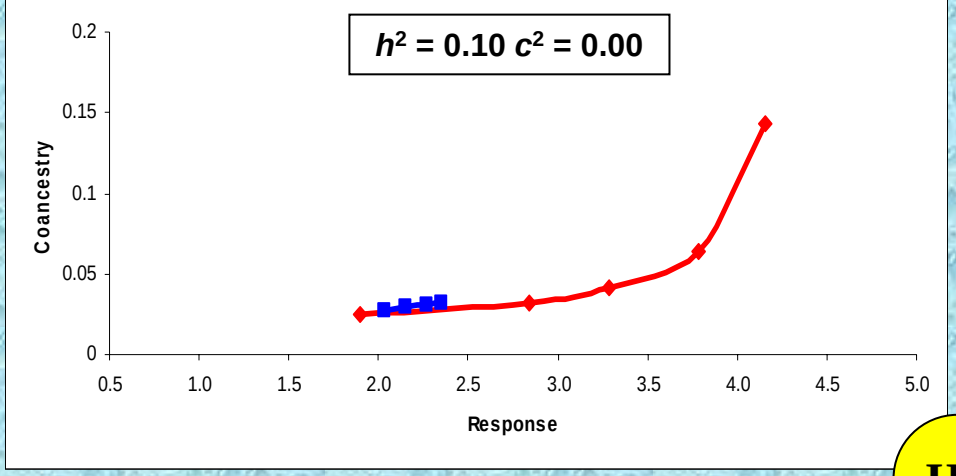
0.05
0.1
0.15
0.2
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
7.5
8.0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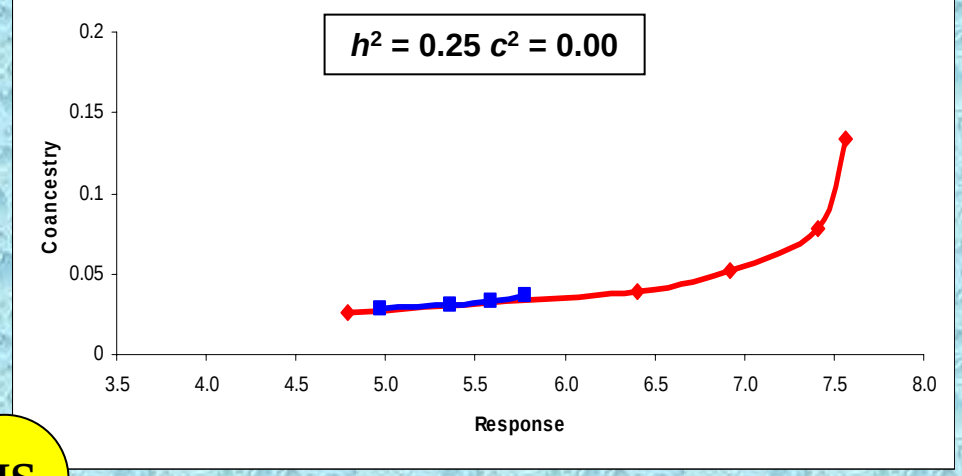
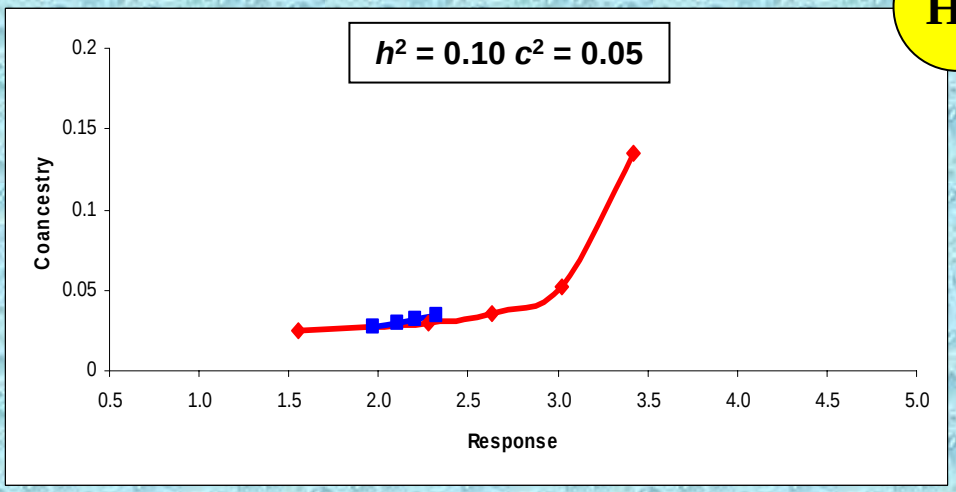
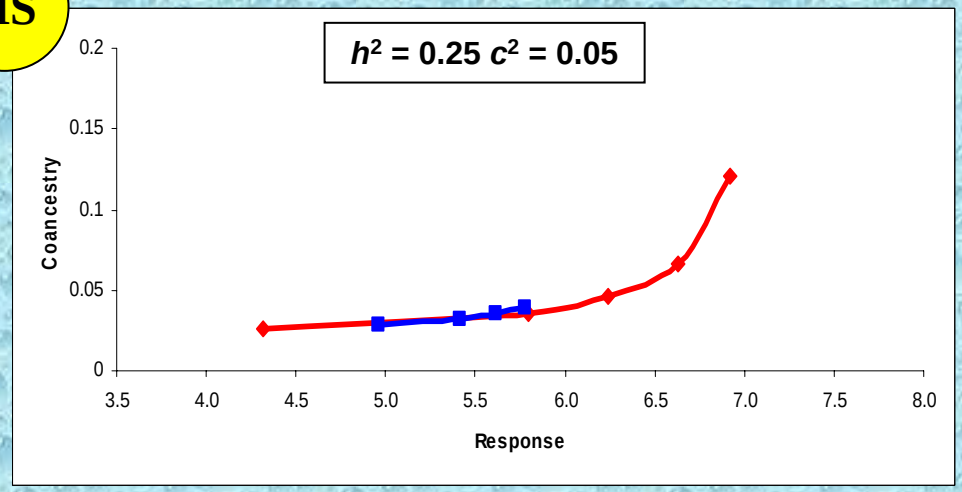
Coancestry
Response


$h^2 = 0.25\ c^2 = 0.00$
Coancestry
Response

HS


$h^2 = 0.10\ c^2 = 0.05$
Coancestry
Response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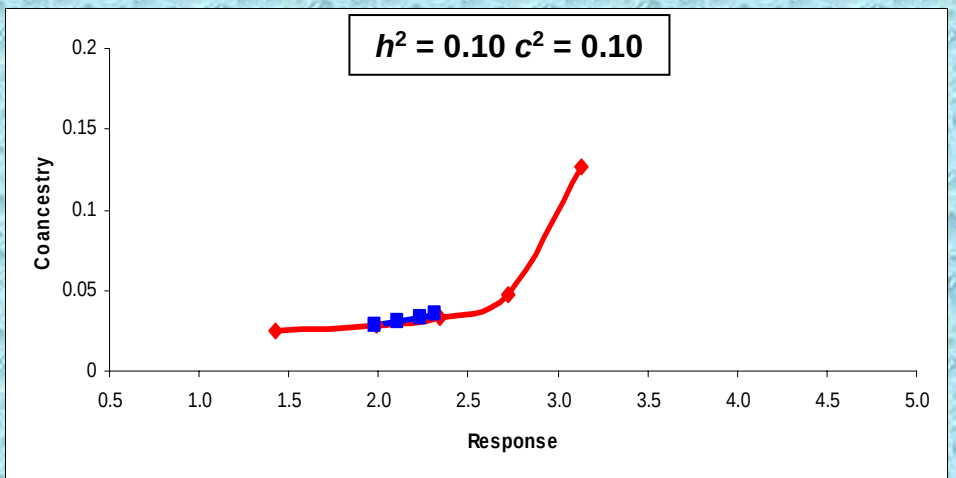
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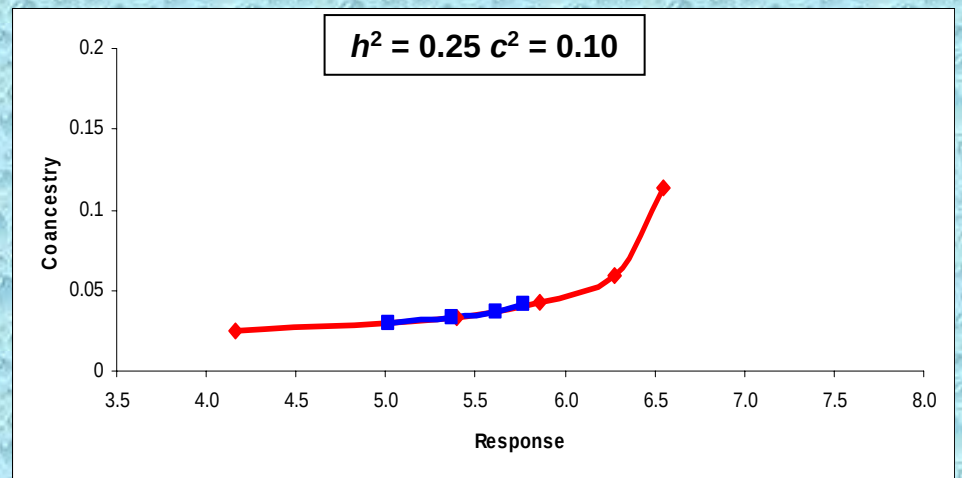
Coancestry
Response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Coancestry
Response

			Response			Coancestry of selected		
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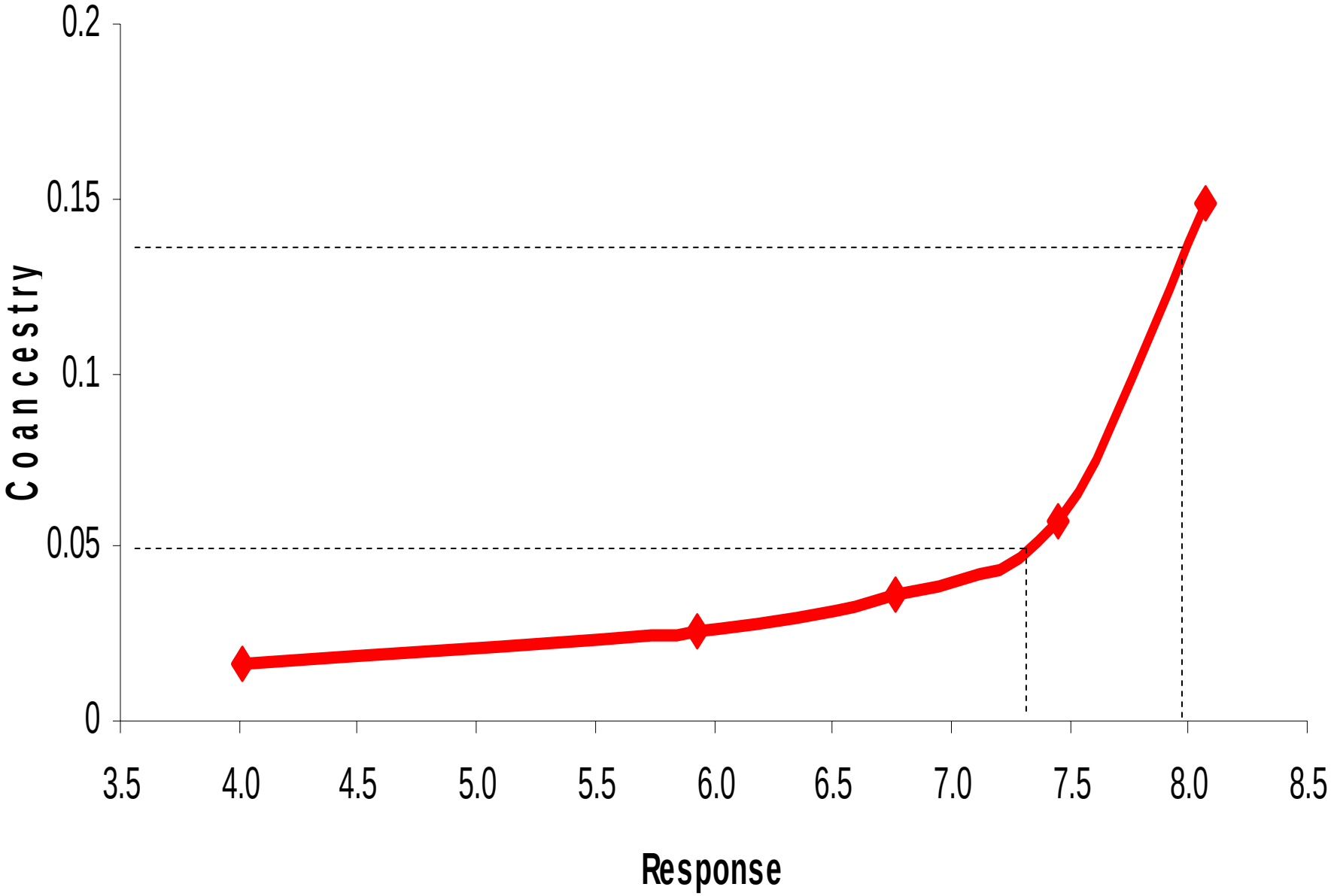
		0,05	3,51	2,87	2,27	0,17	0,04	0,03
		0,10	3,09	2,52	2,28	0,15	0,03	0,03
	0,25	0	8,07	7,45	5,76	0,15	0,06	0,03
		0,05	7,21	6,64	5,74	0,14	0,05	0,03
		0,10	6,65	6,14	5,72	0,13	0,04	0,04
HS	0,10	0	4,16	3,78	2,35	0,14	0,06	0,03
		0,05	3,42	3,02	2,33	0,13	0,05	0,03
		0,10	3,13	2,72	2,31	0,13	0,05	0,04
	0,25	0	7,57	7,41	5,78	0,13	0,08	0,04
		0,05	6,92	6,63	5,78	0,12	0,07	0,04
		0,10	6,55	6,27	5,77	0,11	0,06	0,04

98 - 82 %

62 - 20 %


0.2
0.15
0.1
0.05
0
Coancestry
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
7.5
8.0
8.5
Response

$$\max \sum_{i=1}^{NF} EBV_i \cdot x_i$$

with the restriction

$$\left(\sum_{i=1}^{NF} \sum_{j=1}^{NF} x_i x_j f_{ij} \right) \leq f_{\max}$$

✓ **more interest in response**

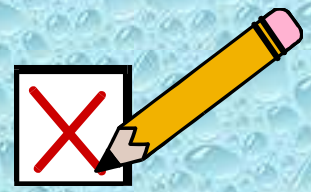
$$\min \left(\sum_{i=1}^{NF} \sum_{j=1}^{NF} x_i x_j f_{ij} \right)$$

with the restriction

$$\sum_{i=1}^{NF} EBV_i \cdot x_i \geq R_{\min}$$

✓ **more interest in inbreeding**

- ✓ relatives’ information does affect inbreeding
- ✓ a compromise solution can be found



- ✓ more generations extension
- ✓ implementing control of contributions

THANK YOU FOR YOUR ATTENTION