Gene Banking and Cryopreservation Training Workshop

1-3- June 2010 – CGR, Wageningen UR, Lelystad

Cost-effective conservation programmes: combining semen and embryos

Paul Boettcher & Gustavo Gandini

Cost components

Costs for creation of the gene bank: collection (animal, health tests, quarantine, training, collection, animal maintenance between collections, hormone treatments (embryos), testis (epididymus spermatozoa)) **and processing of the material**

Costs of storage per year: liquid nitrogen, tanks, alarm systems, buildings

Costs to make use of the genetic material, e.g. costs for breed reconstruction

Time required to make use of genetic material, e.g. time for breed reconstruction

Estimation of unitary costs

Costs may differ as a function of:

- **Country**
- **Availability of facilities, semen market, etc.**
- **Methodology**
- **etc.**

The costs of breed reconstruction from cryopreserved material in mammalian livestock species

Boettcher et al. (GSE, 2005); Gandini et. al (GSE, 2007)

Methodology used

Comparing, in term of costs, the creation of gene banks for breed reconstruction:

- **Three strategies:**
  - Embryos,
  - Embryos in combination with semen,
  - Semen.

- **Three cost measures:**
  - time required for population reconstruction,
  - cost for creation of the gene bank,
  - number of years-keeping-female to reach reconstruction.

The costs of breed reconstruction from cryopreserved material in mammalian livestock species (cont.)

•Scenarios:

Semen collection costs:

- •purchasing semen from standard commercial semen market (S-com)
- •absence of a market: costs based on unitary costs of collection (assumed equipments available in commercial AI station) (S-nocom)
- •commercial semen costs + cost of animals (S-com + donors)
- •semen extracted from epididymus (S-epidid)

Embryos costs:

- •collection at farm, use of equipments available in commercial AI station

Some costs were not internalised: transport, logistic, purchasing testis, etc .

The costs of breed reconstruction from cryopreserved material in mammalian livestock species (cont.)

Costs of semen, embryos, donor animals (Euro) estimated by experts in 5 EU countries.

		Cattle	Horse	Sheep	Pig	Rabbit
Ejaculated semen	**Commercial dose**	1 (0.5–2)	40 (35–50)	5 (4-7)	9 (5-15)	3 (1.5-4)
	Collection (1st)	965	1,406	361	835	146
	Collection (>1st)	53	82	21	54	18
Epididymal semen		0.8		1	15	
Embryos	**In vivo**	100	600	70	80	6
Donors		1,688	1,688	300	270	7

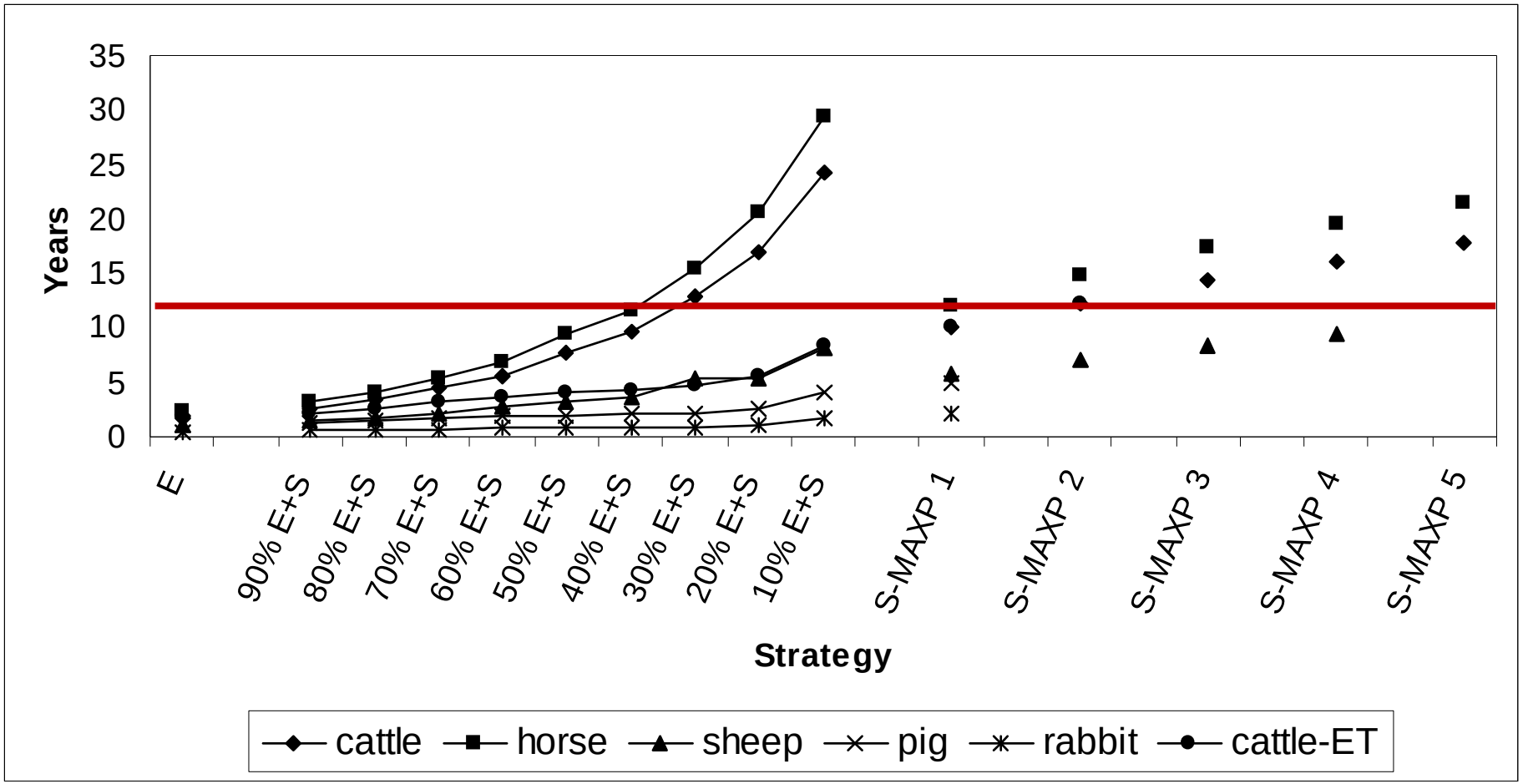
The costs of breed reconstruction from cryopreserved material in mammalian livestock species (cont.)

N. of donors, embryos and semen doses, as a function of strategy and species

Strategy	All species			Cattle / Horse	Sheep	Pig / Rabbit	cattle-ET
	Female donors	Male donors	Embryos	Doses of semen			
Embryos-only	25		348 - *430*				
Embryos+semen							
% embryos 3							
90	22	3	388	22 – *96*	14 – *48*	4 – *14*	6 - *30*
80	20	5	344	50 – *150*	28 – *88*	8 – *20*	14 - *54*
70	17	8	300	88 – *184*	52 – *112*	12 – *24*	36 - *84*
60	15	10	258	126 – *248*	72 – *122*	16 – *28*	52 - *96*
50	12	13	216	216 – *408*	90 – *128*	22 – *34*	76 - *120*
40	10	15	172	274 – *472*	102 – *144*	28 – *48*	98 - *138*
30	7	18	130	370 – *612*	130 – *200*	32 – *52*	100 - *128*
20	5	20	86	452 – *682*	130 – *198*	36 – *56*	92 - *120*
10	2	23	44	512 – *740*	154 - *212*	32 - *48*	78 - *108*
Semen-only							
MAXP 4		25					
5				1,172			
4				1,272	798		
3				1,664	822		
2				3,620	1,134		484
1				25,684	5,998	260	612

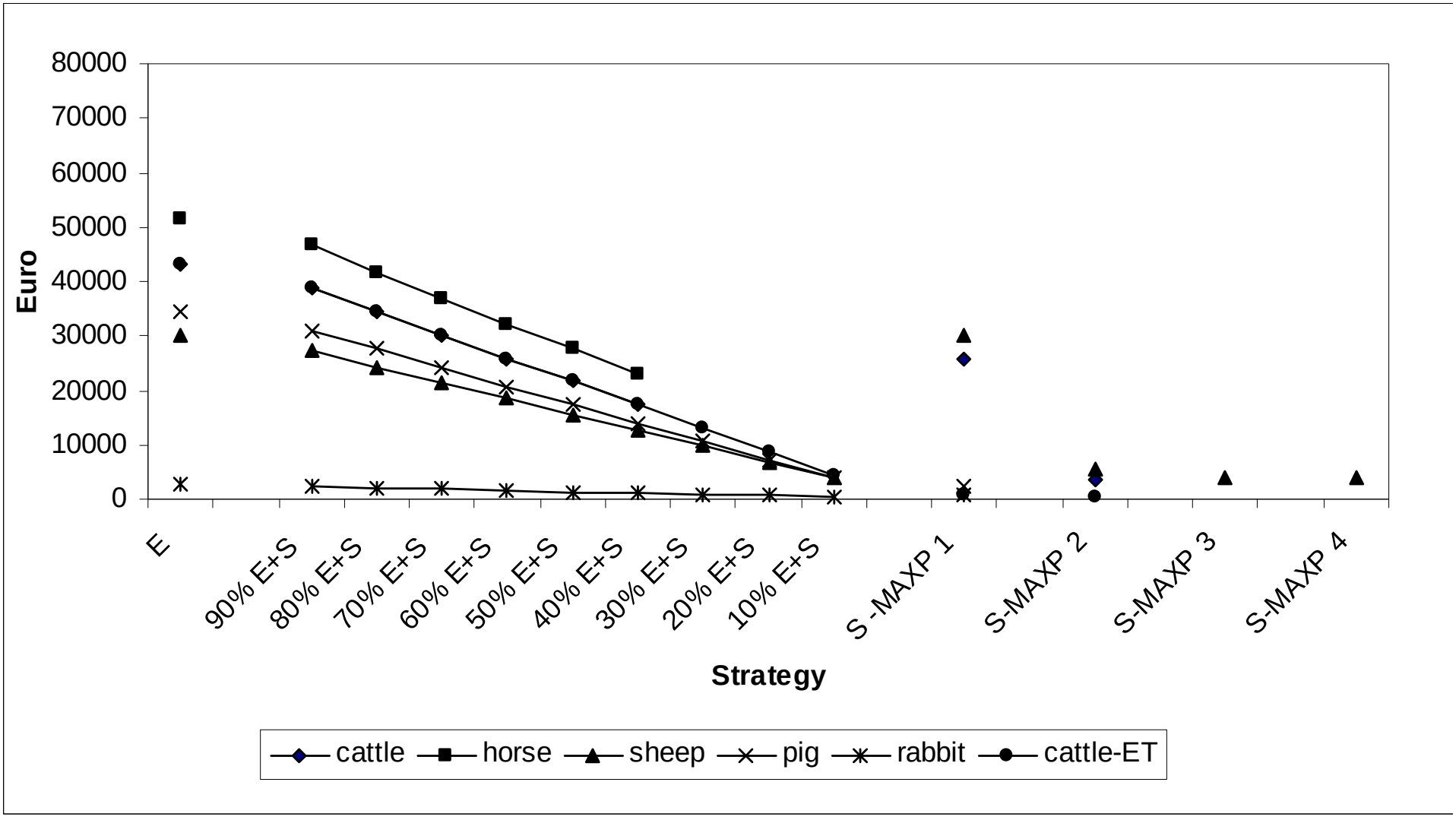
The costs of breed reconstruction from cryopreserved material in mammalian livestock species (cont.)

Number of years for breed reconstruction, according to strategy and species

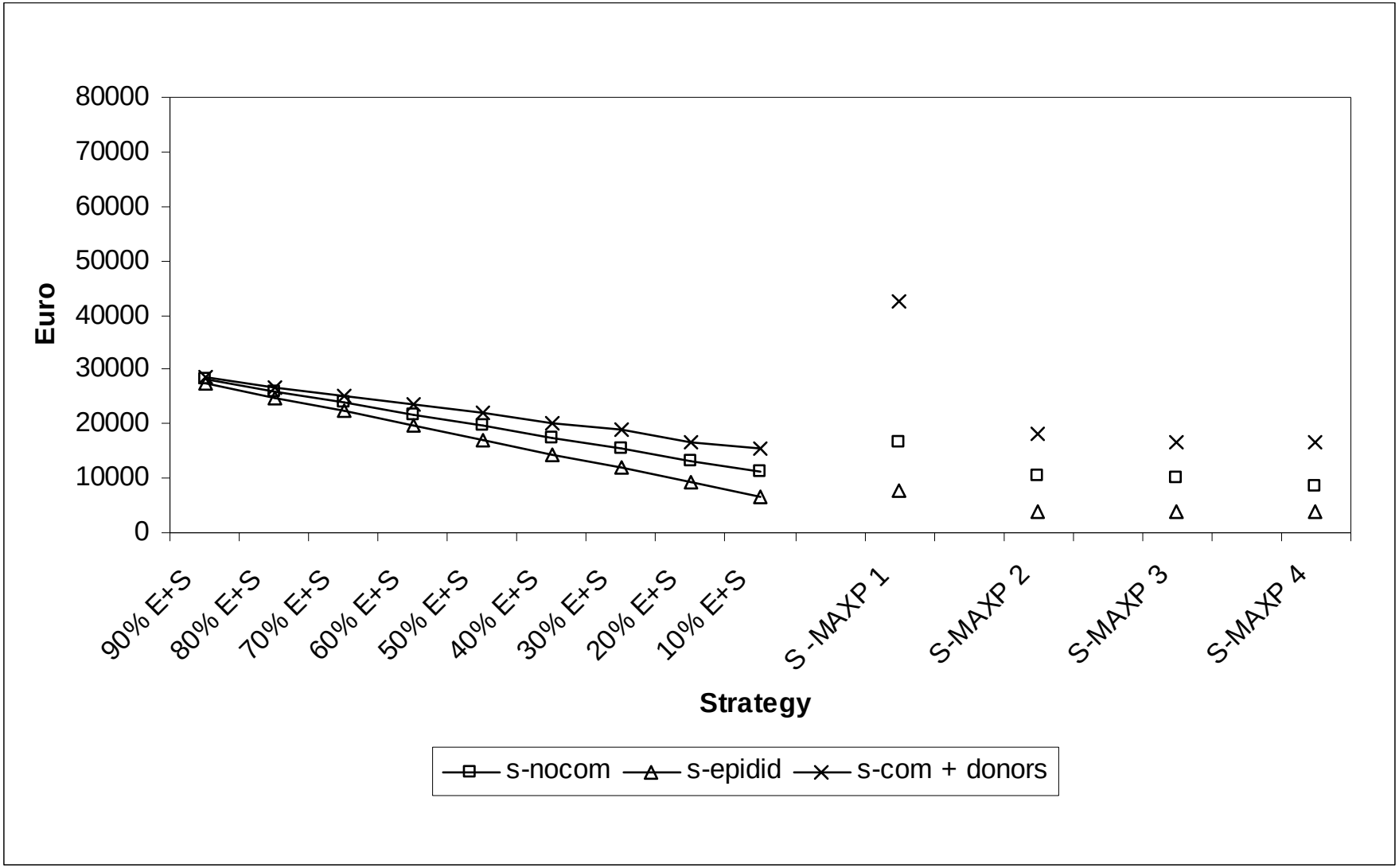


12 years assumed as reasonable maximum time

Costs (Euros) for the creation of the cryo-bank, across strategies and species. For semen, assumed the commercial scenario



Costs (Euros) for the creation of the Cryo-bank in the sheep across strategies and semen costs scenarios.



The costs of breed reconstruction from cryopreserved material in mammalian livestock species (cont.)

N. of years-keeping female during recosntruction, as a function of strategy and species

Strategy	Cattle	Horse	Sheep	Pig	Rabbit	Cattle-ET
Embryos-only	35.1	42.2	21.1	18.8	9.3	35.1
Embryos+semen % embryos [2]						
90	40.3	48.7	17.6	5.2	2.2	11.4
80	54.8	66.2	22.7	9.3	3.9	15.8
70	77.8	94.0	31.5	12.7	5.3	26.9
60	103.2	124.8	40.8	14.5	6.0	32.4
50	166.2	200.9	51.8	15.5	6.4	38.0
40	208.4	251.9	60.7	16.6	6.9	43.2
30			77.1	18.3	7.6	51.2
20			77.1	25.3	10.5	66.9
10			87.7	30.5	12.7	74.9
Semen-only MAXP [3]						
4			144.2			
3			157.3			
2	1,231.9		240.5			195.3
1	12,877.5	15,581.5	1,775.5	84.0	36.6	341.3