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A selection and mating strategy to optimize genetic gain and rate of inbreeding in the Swiss pig breeding program

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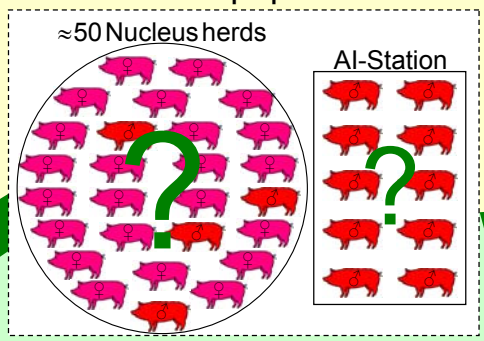
Conclusion

In small nucleus populations inbreeding may increase fast and could affect the long-term genetic gain. SUISAG uses the GENCONT software based on the optimal contribution theory to select sows and boars for elite matings. The selection accounts for the breeding value and the average relationship of the candidate to the complete nucleus population. Genetic gain is maximised while restricting the average relationship to a specified value and thus controlling the rate of inbreeding. The corrective mating strategy of selected animals enables to produce competitive offspring even out of parents with a low breeding value and thus preserving rare genes in the nucleus.

Introduction

SUISAG implements a new procedure based on the optimal contribution theory to select and to mate sires and dams within the Swiss pig breeding program. Nucleus sows in heat within the next month and all available boars (AI & NS) within each nucleus line are pre-selected according to minimal requirements on breeding values.The final selection of boars and sows to be mated is performed by the GENCONT software (Meuwissen and Sonesson, 1998).

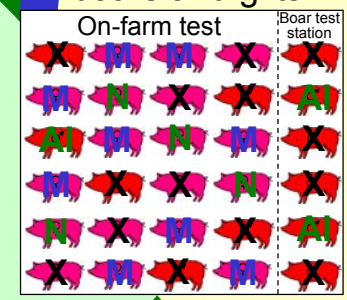
Nucleus population



At first, we use this strategy for elite matings to select new AI-boars from the male offspring. SUISAG will extend the number of planned matings to produce all female replacements in nucleus herds.

Multipliers

Selection of boars and gilts



Selection of elite matings

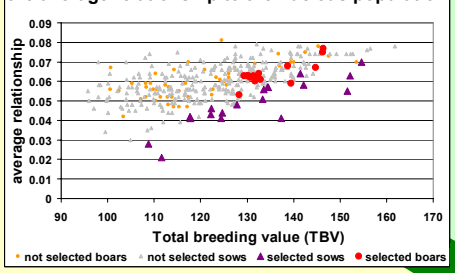
		selected by GENCONT N: boars: 15 sows: 20 ♂ Mean	SD	Min	Max	candidates ♂64 ♀302 Mean	SD
Total BV	♂	**134.3**	7.1	120.4	146.4	**123.2**	13.2
	♀	**130.5**	13.0	108.8	154.6	**123.4**	13.1
Reprod. BV	♂	**117.7**	13.0	100.7	145.2	**114.3**	12.9
	♀	**124.2**	14.4	103.8	155.8	**118.4**	13.2
Prod. BV	♂	**137.6**	15.9	114.2	162.0	**118.9**	20.0
	♀	**119.9**	13.6	96.1	146.2	**114.3**	15.7
Leg BV	♂	**113.7**	13.2	85.7	145.5	**114.9**	14.8
	♀	**107.9**	16.9	85.6	155.4	**109.0**	13.6
Teat BV	♂	**103.2**	9.4	86.7	119.0	**108.1**	11.3
	♀	**105.0**	11.0	85.6	125.6	**106.4**	10.4
avg. relations.	♂	**0.064**	0.006	0.053	0.077	**0.061**	0.008
	♀	**0.048**	0.012	0.012	0.070	**0.060**	0.010

Selection & mating decisions each month

Benefit of corrective matings

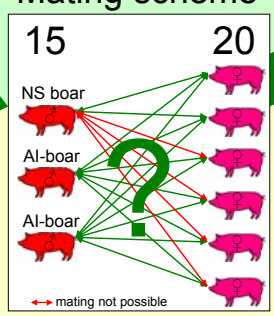
	20 elite matings expected breeding values of the offspring Mean	SD	Min	Max
Total BV	132.8	**7.1**	**114.6**	148.9
Reprod. BV	122.5	**11.1**	**106.0**	150.5
Prod. BV	127.4	**11.2**	**106.6**	149.1
Leg BV	109.7	**10.0**	**96.9**	131.3
Teat BV	104.1	**6.6**	**92.0**	115.8
inbreeding coefficient	2.65%		**1.02%**	8.66%

Association between total breeding value and the average relationship to the nucleus population



GENCONT selects animals with high breeding values and / or a low average relationship to the nucleus population to maximize the genetic gain while maintaining the constraint relationship value of the expected population. Up to a maximum limit of matings per boar (settable by users) the program provides the optimal number of matings for each selected boar.

Mating scheme



A mating score developed by SUISAG and a linear programming technique (Jansen and Wilton, 1985) is used to find a mating scheme, that reduces the variation of the expected breeding values of offspring. Especially selected sows with low breeding values but also a low relationship have to be mated with the best boars. The corrective mating strategy enables to produce competitive offspring even out of parents with a low breeding value and thus preserving rare genes in the nucleus.

References: Meuwissen T.H.E., Sonesson A.K., 1998: Maximizing the response of selection with a predefined rate of inbreeding: Overlapping gernerations. J. Animal Sci. 76: 2575-2583
Jansen G.B., Wilton J.W., 1985: Selecting Mating Pairs with Linear Programming Techniques. J. Dairy Sci. 68: 1302-1305