Inbreeding and Relationship Among Prominent Hampshire Boars

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Story in Brief

A listing of leading Hampshire boars published by the Hampshire Swine Registry was used to evaluate the inbreeding of and the relationships among prominent Hampshire boars during the 1970's. The average inbreeding coefficient in the most recent listing was .103. The average relationship of these boars to the five most prominent boars of the 1970's ranged from .202 to .385. These results indicate that while the average inbreeding has remained relatively low, the average relationship is close to what would be expected from a half-sib or grandparent-grand offspring relationship. If the inbreeding and relationship coefficients of these 45 boars reflect levels in the Hampshire breed in general, then Hampshire breeders must remain cautious that the average inbreeding level does not increase much more and that such high relationships are maintained with only truly superior herdsires.

Introduction

Seedstock producers who are trying to develop a uniform set of breeding stock to sell frequently resort to inbreeding, which is the mating of individuals more closely related than the average of the breed. Extensive inbreeding results in a detrimental effect called inbreeding depression. This depression in performance can be substantial for traits associated with reproduction. However, inbreeding does promote uniformity and makes family development possible. The purpose of this study is to evaluate the level of inbreeding in some widely used Hampshire boars.

Materials and Methods

In the July issue of the *Hampshire Herdsman* the Hampshire Swine Registry publishes a list of the top herdsires of the breed. The list for 1981 included 45 boars. The ranking was based on the performance of descendents in breeding shows, barrow shows and test stations. More than 1200 total descendents of these 45 boars were used to establish the ranking for 1981.

Pedigrees were developed for these 45 boars which included at least three generations and, in most cases, up to seven or eight generations. These pedigrees were combined to form a composite pedigree of 203 individuals. This pedigree illustrated the relationships among all individuals and made the high degree of relationship among the leading boars apparent. The composite pedigree was used to identify all sires and dams of pigs, and this information was submitted to the Inbreeding Program that is part of the Statistical Analysis System. This program was used to calculate all inbreedings and relationships among the pigs in the composite pedigree.

The inbreeding coefficient is a measure of the probability that an individual received identical genes from each parent as a result of the parent's having ancestors in common. It is a function of how often the common ancestors appear in the pedigree and how closely they are related to the individual in question. The inbreeding is increased if the common ancestor is also inbred.

The coefficient of relationship is the probable proportion of genes that are the same for two individuals because of common ancestry. It is also a function of how closely the common ancestors are related to the two individuals in question and the number of times they appear in the pedigree.

Results and Discussion

The inbreeding coefficients of the 45 boars in the 1981 listing are shown in Table 1 along with their relationships to five prominent Hampshire boars of the 1970's. The averages and ranges of these coefficients are in Table 2 to provide a summary. The average inbreeding was .103, with a range of 0 to .297. The average is slightly less than the .125 which would be expected when a half-sib mating is made. It is not large enough to expect a large decline in performance due to inbreeding depression.

The highest inbreeding level for any of these boars was .297 for a boar named Willie whose parents were full sibs. The inbreeding for an individual resulting from mating non-inbred full-sibs is .25. The added inbreeding is a result of Willie's parents being inbred themselves.

Five of the boars in the composite pedigree were designated as the most prominent boars (Ugh, Roughneck, Gem, Oh and Eric). This was based upon the number of offspring they had that were also in the composite pedigree. These boars were prominent boars in the Hampshire breed throughout the 1970's. Ugh, Roughneck and Gem were still on the list of leading herdsires in 1981. Oh and Eric were both on the list during previous years. None of these boars have very high inbreeding coefficients. Ugh has the highest with a coefficient of .076.

The average relationship of these boars to the leading herdsires of 1981 is quite high. Ugh, Roughneck and Gem all have an average relationship to the other boars on the 1981 list over .34. Individual boars have relationships to these boars of near .60. An offspring-parent relationship is .50 if there are no other sources of relationship. Full sibs also have a relationship of .50. A half-sib or a grandparent-grand offspring relationship is .25. The average relationship of the leading herdsires of 1981 with Ugh, Roughneck and Gem is between those of full-sibs and half-sibs.

Oh and Eric were active herdsires in the early to mid-1970's. They appeared in the pedigrees of the sires on the 1981 list no closer than grandsire and frequently from four to eight generations back. Despite this, their average relationships to the boars on the 1981 list were .202 and .234 for Oh and Eric, respectively. These were nearly as high as if they were grandsires of all the boars. The magnitude of the relationships is due to the large number of times they appear in the pedigrees of many of the boars. An example of this was the relationship of Ark and Eric (.238). The nearest Eric appears in Ark's pedigree is five generations back but he is in the pedigree more than 10 times.

Linebreeding is a commonly used practice in pure breeds of livestock. The goal of linebreeding is to maximize relationship to a certain outstanding individual while keeping inbreeding at an acceptably low level. It appears that if Hampshire breeders have been trying to linebreed to some of these prominent boars they have been successful. The dangers of linebreeding are that inbreeding may

Table 1. Inbreeding coefficients of leading Hampshire boars of 1981 with their relationships to 5 prominent boars of the last decade

Sire	1981 Rank	Inbreeding	Ugh	Roughneck	Gem	Oh	Eric
Roughneck	1	.075	.572	—	.567	.121	.350
Ugh	2	.076	—	.572	.370	.169	.262
Brad	3	.082	.397	.576	.347	.147	.320
Sap 14-3	4	.126	.606	.447	.452	.148	.243
Gem	5	.054	.370	.567	-	.190	.236
Dino	6	.093	.248	.335	.579	.398	.116
Ha Invoice	7	.170	.240	.340	.546	.238	.224
Willie 25-2	8	.297	.236	.324	.523	.315	.214
Ha Oliver	9	.121	.602	.433	.447	.252	.186
M 43-1	9	.133	.366	.611	.420	.105	.342
DL Bracer	11	.116	.276	.422	.432	.270	.173
Slim	12	.016	.322	.530	.315	.191	.180
Flex	13	.160	.628	.490	.456	.207	.240
Haymaker	14	.081	.254	.340	.571	.362	.175
Ark 11-2	15	.109	.422	.410	.351	.117	.238
Wildman	16	.039	.161	.208	.324	.277	.119
Gembo	17	.088	.276	.386	.575	.356	.232
Ha Noel	18	.133	.610	.459	.451	.129	.299
Capt Ugly	18	.054	.220	.356	.197	.072	.206
Bombshell	20	.145	.148	.172	.211	.309	.113
Pioneer	21	.134	.341	.451	.458	.203	.242
TWA	21	.123	.280	.393	.598	.169	.343
Bulldozer	23	.066	.211	.249	.353	.374	.117
Ha Trigger	24	.151	.622	.474	.453	.160	.241
Lumberjack	24	.128	.164	.214	.158	.072	.457
Izaac	26	.062	.174	.227	.348	.256	.177
Fred	27	.153	.479	.485	.378	.136	.247
Ha Acutron	28	.138	.468	.461	.331	.162	.235
DL Eric	28	.151	.353	.485	.392	.215	.212
PBR	30	.041	.342	.547	.352	.217	.178
DL Kevin	31	.165	.339	.527	.315	.161	.239
Clout	32	.173	.468	.448	.447	.163	.266
ELK	32	.080	.259	.399	.236	.086	.175
Waylon	32	.137	.613	.445	.458	.259	.213
Guts	32	.204	.210	.313	.358	.186	.207
Bigfoot	36	.000	.209	.317	.147	.057	.483
Smokey	36	.023	.334	.145	.177	.222	.180
Duff 22-2	38	.086	.273	.374	.320	.140	.204
Flat Tires	39	.016	.315	.530	.315	.191	.180
Ha Quota	39	.151	.622	.474	.453	.160	.241
Iron Horse	39	.029	.115	.148	.138	.070	.283
Grouchy	42	.081	.258	.353	.571	.343	.233
Harvey	42	.100	.360	.190	.186	.319	.347
Stump	44	.025	.119	.144	.130	.131	.258
W Trucker	45	.052	.137	.167	.221	.257	.118

eventually build up and cause a decline in performance and that the individuals that are line bred to may not be truly outstanding. Hampshire breeders need to be aware of these dangers if they plan on continuing the types of breeding systems they currently have.

Table 2. Average inbreeding of the leading Hampshire boars of 1981 and the average relationship between those boars and the most prominent boars in the pedigrees

| | Inbreeding | Relationship | | | | |
		Ugh	Roughneck	Gem	Oh	Eric
Average	.103	.341	.385	.373	.202	.234
Range	0-.30	.12-.63	.14-.58	.13-.60	.06-.40	.11-.48

Correlations Between Type and Performance of Boars at the Oklahoma Swine Evaluation Station

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Story in Brief

Visual scores and performance data accumulated on 201 boars during the fall of 1980 and the spring of 1981 were used to evaluate the relationship between visual appraisal and performance data. Performance traits measured were: average daily gain, backfat thickness, feed efficiency and loin eye area. Visual scores for frame, capacity, muscling, front and rear leg structure and movement were assigned at the beginning and the end of the test.

Few of the visual scores were highly correlated with the performance traits. The correlations between average daily gain and final frame score (.329) and final capacity scores (.664) suggest that larger framed, higher capacity boars grow faster than smaller framed boars with less capacity. Correlations between initial and final body type scores were moderate (.449 to .613) while correlations between initial and final leg structure and movement scores were small (.078 to .226). There was more agreement among scorers for body type scores than for feet and leg scores, and the scores agreed more closely at the end of the test than at the beginning.