# PROGENY TESTING OF DAIRY CATTLE ON PUREBREDS AND CROSSBREEDS

## Nachkommensprüfung in Reine- und Kreuzungsrassen

## L'épreuve de la descendance chez les races pures et croisées de bovin laitier

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The usual method employed in progeny testing of dairy sires is to test the sire in question on the dams of the same breed. This, in other words, means that the offspring of the sire in question will be purebreds. This, of course, has resulted in a loss of material which otherwise should be used. Some countries embark on intensive crossbreeding in an attemp to uppgrade their own breed's while others do cross at times to exploit non-additive effects. The results of such crosses are not used in progeny testing of sires. An attempt is made at progeny testing using crossbreds and comparing the results with progeny testing based on purebreds.

The material is three breed crosses of Ayrshire (SAB), Friesian (SLB) and Red and white (SRB) breeds.

It has been shown from previous studies that certain breed combinations may produce more desirable progeny than others. Also some previous results had shown that sex linked genes and maternal abilities accounted for differences between reciprocal crosses. It has also been pointed out previously that increasing the number of daughters per sire removes the errors due to temporary environment but not that due to permanent environment, dominance or epistasis. Some factors which are not due to sires breeding value but which may cause the daughters of a sire to be above or below breed average or be similar but vary from one sire to another or even breeding mates of a sire being similar will bias progeny test. If specific combining ability happens to be an important source of variation the ranking of lines, breeds or individuals may not be the same in the purebred as in the crossbred.

If the sires rank differently in the purebreds and crossbreds it means that

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## TABLE 1

EXPECTED BREEDING VALUES (EBV) OF 28 SIRES ON FAT CORRECTED MILK COMPARED WITH SWEDISH SIRE PROOF ON SAME SIRES

| Purebred | | | | Swedish | | | | Crossbred | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Sire name | Code | No. of progeny | EBV | Sire name | Code | No. of progeny | EBV | Sire name | Code | No. of progeny | EBV |
| SRB | | | | | | | | | | | |
| A | Hanse . . . . | 67 | 398 | A | Hanse . . . . | 129 | 112 | A | Hanse . . . . | 7 | 178 |
| B | Honnör . . . | 163 | 238 | C | Ogestad . . . | 1241 | 111 | E | Hasse . . . . | 77 | 152 |
| C | Ogestad . . . | 28 | 187 | F | Hussar . . . | 82 | 106 | C | Ogestad . . . | 5 | 124 |
| D | Sannagärd. . | 61 | 110 | B | Honnör . . . | 565 | 105 | B | Honnör . . . | 22 | 35 |
| E | Hasse . . . . | 51 | — 58 | E | Hasse . . . . | 141 | 103 | H | Bister . . . . | 5 | — 23 |
| F | Hussar . . . | 51 | — 130 | H | Bister . . . . | 204 | 100 | D | Sannagärd. . | 5 | — 57 |
| G | Tomten Hekt | 73 | — 162 | D | Sannagärd. . | 280 | 100 | I | Hugin . . . . | 5 | — 70 |
| H | Bister . . . . | 65 | — 166 | I | Hugin . . . . | 142 | 99 | F | Husar . . . . | 6 | — 73 |
| I | Hugin . . . . | 12 | — 169 | G | Tomten Hekt | 216 | 97 | G | Tomten Hekt | 9 | — 279 |
| SLB | | | | | | | | | | | |
| J | Julle . . . . | 6 | 196 | R | Bestman . . | 1000 | 110 | J | Julle . . . . . | 24 | 232 |
| K | Stabil . . . . | 8 | 196 | V | Klaas . . . . | 227 | 110 | K | Stabil . . . . | 16 | 139 |
| L | Pixman . . . | 11 | 131 | N | Safir . . . . | 201 | 109 | N | Safir . . . . . | 10 | 57 |
| M | Matros . . . | 7 | 103 | K | Stabil . . . . | 712 | 108 | V | Klaas . . . . | 5 | 43 |
| N | Safir . . . . | 8 | 34 | J | Julle . . . . . | 657 | 108 | T | Danilo . . . . | 17 | 36 |
| O | Rock . . . . | 18 | 19 | S | Bestman . . | 540 | 108 | U | Tiarp . . . . . | 14 | 15 |
| P | Ruter . . . . | 6 | — 34 | U | Tiarp . . . . | 255 | 107 | S | Bestman . . . | 22 | — 1 |
| Q | Hovgärd. . . | 9 | — 54 | T | Danilo . . . . | 377 | 106 | L | Pixman . . . | 22 | — 10 |
| R | Bestman . . | 7 | — 71 | O | Rock . . . . | 1140 | 106 | P | Ruter . . . . | 15 | — 19 |
| S | Bestman . . | 14 | — 99 | Q | Hovgärd. . . | 1435 | 105 | O | Rock . . . . . | 25 | — 61 |
| T | Danilo . . . | 16 | — 227 | L | Pixman . . . | 730 | 105 | M | Matros . . . . | 11 | — 67 |
| U | Tiarp . . . . | 13 | — 241 | M | Matros . . . | 1435 | 104 | R | Bestman. . . | 5 | — 103 |
| V | Klaas . . . . | 14 | — 247 | P | Ruter . . . . | 103 | 104 | Q | Hovgärd. . . | 20 | — 151 |
| SAB | | | | | | | | | | | |
| W | Matti . . . . | 11 | 74 | W | Matti . . . . | 61 | 110 | W | Matti . . . . | 86 | 67 |
| X | Licens . . . . | 6 | 70 | α | Merola . . . | 63 | 107 | Y | Mäki . . . . | 39 | 56 |
| Y | Mäki . . . . | 7 | 62 | X | Licens . . . . | 32 | 104 | Z | Marsk . . . . | 11 | 47 |
| Z | Marsk . . . . | 5 | 51 | β | Mikkula. . . | 64 | 102 | α | Merola . . . | 66 | 15 |
| α | Merola . . . | 6 | 18 | Y | Mäki . . . . | 87 | 102 | β | Mikkula . . . | 30 | — 42 |
| β | Mikkula. . . | 6 | — 72 | Z | Marsk . . . . | 49 | 98 | X | Licens . . . . | 8 | — 59 |

the above mentioned facts have affected the ranking either individually or collectively. Despite the fact that there was an average of 25 purebreds and 16 crossbreds per sire, a number which is supposed to be inadequate judging from previous results, the sires ranked almost the same. The agreement was better in the ranking of very good and very poor sires, Table 1, whereas the trend in the intermediate sires was not very straight forward. This discrepancy may have been caused by sampling variance because of the small number of progenies per sire involved. The agreement was best in SRB followed by SAB and finally SLB.

It may happen that a better agreement may be obtained if the number of offspring is increased because increase in the number of offspring will reduce sampling variance. Despite the fact that only 28 sires have been involved with a consequent low power of test, the above mentioned facts have not affected the ranking of the sires considerably.

If there is a very high genetic correlation between purebreds and crossbreds it follows that the genes that operate in the purebreds also do so in the crossbreds and consequently progeny test based on purebreds will improve crossbreds. Some earlier investigations had shown that a regression coefficient of purebred progeny performance on crossbred progeny performance of the same sire may be negative if overdominance is present or negative covariance can be obtained while a positive or zero regression does not necessarily imply absence of overdominance. Some previous regressions on productivity of purebred daughters on crossbred daughters were mainly negative.

In the present investigation despite the fact that some sires had only five crossbred progenies the covariance and consequently the genetic correlation were positive. The genetic correlation was in the upper limit or 1.

A comparison of correlated with direct response showed a ratio of 0.9 which is almost of the same magnitude as genetic correlation. It shows that greater improvement will be obtained throug direct selection based on the crossbreds.

Judging from the present result it looks as if crossbreds could be used in progeny testing. This will mean making use of the records of crossbreds which are normally discarded in progeny tests and also increasing the accuracy in sire proof through the inclusion of crossbred data. The use of crossbreds in progeny testing will be of great use to some countries which do crossbreed from time to time and also those that practice intensive crossbreeding in an attempt to upgrade their own stock.


## RESUME

La méthode conventionnelle d'examen de la progéniture de taureaux de races laitières a été utilisée pour examiner ces taureaux sur des femelles de la même race. Le résultat de ceci a été la perte du matériel qui aurait pu être utilisé d'une autre façon, surtout dans des pays où l'on pratique le croisement de races pour essayer d'améliorer le bétail local ou d'exploiter l'effet d'hétérose. Ici nous avons fait une tentative pour que les taureaux en *progeny test* inséminent des vaches de race pure et des croisées. Il y avait en moyenne 25 vaches de race pure et 16 croisées par taureau. Les taureaux en épreuve se classèrent presque de la même façon aussi bien les vaches de race pure que les croisées. Le résultat était meilleur chez les très bons taureaux et chez les moins bons tandis que la tendance chez

les taureaux moyens était plus difficile à dégager. La tendance des résultats semble pointer le fait qu'un meilleur résultat pourrait être obtenu si le nombre de descendants par taureaux était augmenté. 28 taureaux en tout furent testés, 9 Red and White (SRB), 13 Frisons (SLB), et 6 Ayrshire (SAB). La corrélation génétique entre las animaux de race pure et les croisements était à la limite supérieure et positive. Une comparaison des éléments ayant fait l'objet de la corrélation avec réponse directe montra un érreur de presque la même magnitude que la corrélation génétique. Ceci à son tour pourrait être interprété comme montrant le fait qu'une amélioration considérable pourrait être obtenue par une sélection directe des croisements. A en juger du présent résultat il semble que les croisées peuvent être combinés avec les vaches de race pure dans les expériences de progéniture.


## ZUSAMMENFASSUNG

Die herkömmliche Methode einen Zuchttest mit Bullen von Milchrassen durchzuführen ist, die Bullen an den weiblichen Tieren derselben Rasse zu testen. Diese Methode resultierte in dem Verlust von Material, das anderweitig hätte verwendet werden können, besonders in Ländern, in denen man Kreuzungen durchführt mit dem Ziel, das eigene Vieh zu verbessern oder den Wachstumseffekt auszunutzen.

Hier wurde der Versuch unternommen, einen Zuchttest mit Milchviehbullen an reinrassigen und gekreuzten Kühen durchzuführen. Im Durchschnitt kamen auf jeden Bullen 25 reinrassige und 16 mischrassige Kühe. Die Bullen hatten fast die gleiche Gradierung bei reinrassigen wie bei gekreuzten Tieren. Die Übereinstimmung war besser bei sehr guten und sehr schlechten Bullen, während der Trend bei den dazwischen rangierenden Bullen nicht ganz deutlich war. Der Trend im Resultat scheint darauf hinzudeuten, dass ein besseres Resultat erreicht werden könnte, wenn die Anzahl der Jungtiere per Bulle erhöht würde. Insgesamt wurden 28 Bullen getestet, nämlich 9 Fleckige Bullen (SRB), 13 Friesische Bullen (SLB) und 6 Ayrshire Bullen (SAB). Die genetische Korrelation zwischen den reinrassigen und den gekreuzten Tieren lag im oberen Limit und war positiv. Ein vergleich der Korrelation mit direktem Respons zeigte eine Proportion von fast der gleichen Grösse wie die genetische Korrelation. Dies seinerseits könnte so interpretiert werden, dass eine grössere Verbesserung erreicht würde durch eine direkte Selektion auf der Basis von mischrassigen Tieren. Nach dem vorläufigen Ergebnis zu urteilen scheint es möglich, gekreuzten Tiere mit reinrassigen Tieren in einem Zuchttest zu vereinen.