Country   Sweden

Trait category:	_Individual trait(s):_
Reproduction-calving	Calving performance (direct, maternal)
	Stillbirth rate (direct, maternal)
Reproduction-fertility	Insemination number (female)
	Calving to first insemination interval (female)
	Heat strength (female)
Health	Clinical mastitis
	Somatic cell count
	Resistance against other diseases
Workability	Milking speed
	Leakage
	Temperament
Conformation	Udder
	Locomotion
	Other
Longevity	Survival

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Reproduction calving traits	Calving performance (direct, maternal) Stillbirth rate (direct, maternal)
Breed(s)	Swedish Friesian, Swedish Red & White
Trait definition and unit(s) of measuring	Calving performance is scored in 2 categories; normal calving (0), hard calving, i.e. veterinary assistance or assistance from 2 or more persons (1). Only single calvings, twin calvings are excluded Stillbirth is scored in 2 categories; alive (0), dead born calves or calves dead within 24 hours after calving (1). Only single calvings, twin calvings are excluded
Method of measuring and collecting data	Farmers fill in milk recording reports
Time period for data inclusion	Since 1982
Age groups	1st calvers with an age between 20 and 36 months
Genetic parameters	$h^2_{\text{calving performance (direct)}} = 0.02$ $h^2_{\text{calving performance (maternal)}} = 0.02$ $r_{g(\text{calving performance (direct, maternal)})} = 0$ $h^2_{\text{stillbirth (direct)}} = 0.02$ $h^2_{\text{stillbirth (maternal)}} = 0.02$ $r_{g(\text{stillbirth (direct, maternal)})} = 0$
Sire categories	AI-bulls

Environmental effects
  pre-adjustment
 	
  evaluation model
	Calves with unknown sex are randomly distributed to females (30%) and males (70%)
	Herd x year, year x calving month, sex, breed of dam, calving age

Base for age adjustment	None
Use of genetic groups and/or relationships	No genetic groups, separately relationship matrices for direct resp. maternal effects considering sire and MGS of the sire resp. MGS
Method (model) of genetic evaluation	ST BLUP SM
System validation	-
Expression of proof	Standardized RBV with M = 100 and SD ≈ 5, higher values are more desirable
Genetic (reference) base	Rolling average RBV of the last three years of tested bulls
Criteria for official publication of sire proofs	≥ 100 calvings
Number of evaluations/ publications per year	Two; January, July

Reproduction calving traits *continued*	Calving performance (direct, maternal) Stillbirth rate (direct, maternal)
Use in total merit index	Calving performance is not included Stillbirth (direct) and (maternal) are included total merit index (Swedish Bull index): Swedish Friesian: 1.00 x milk index (protein yield) + 0.35 x meat index + 0.50 x growth index (not for Swedish Jerseys) + 0.30 x fertility (female) + 0.20 x stillbirth (direct) + 0.30 x stillbirth (maternal) + 0.35 x mastitis resistance index + 0.15 x resistance against other diseases + 0.20 x legs + 0.50 x udder + 0.10 x body + 0.15 [or 0.30] x temperament Swedish Red & White cattle, Swedish Polled, Swedish Jersey: 1.00 x milk index (protein yield) + 0.35 x meat index + 0.50 x growth index (not for Swedish Jerseys) + 0.30 x fertility (female) + 0.10 x stillbirth (direct) + 0.10 x stillbirth (maternal) + 0.30 x mastitis resistance index + 0.15 x resistance against other diseases + 0.20 x legs + 0.50 x udder + 0.10 x body + 0.15 [or 0.30] x temperament
Key reference on methodology applied	Reports 13 and 79 from the Department of Animal Breeding and Genetics. Swedish University of Agricultural Sciences. S-75007 Uppsala, Sweden

Reproduction fertility traits	Insemination number (female) Calving to first insemination interval (female) Heat strength (female)
Breed(s)	Swedish Friesian, Swedish Red & White
Trait definition and unit(s) of measuring	Number of inseminations per service period, scored in 5 categories, from double inseminations (1) to 6 or 7 inseminations (5). Records of cows with more than 7 inseminations, heat synchronized or cows moved from one herd to another herd within one service period, are excluded. Data $\geq$ 60 days after 1st insemination and $\geq$ 150 days after calving are excluded Calving to first insemination interval is the number of days from calving to first insemination, the number of days should be between 20 and 230 days Heat strength is scored in 3 categories; very strong (1), clear (2), weak (3)
Method of measuring and collecting data	Calculated from AI-recording in milkrecording/pedigree recorded herds
Time period for data inclusion	Since 1982
Age groups	Virgin heifers inseminated between 12 and 27 months, heifers calving between 22 and 36 months and 2nd lactation cows
Genetic parameters	Heritabilities and correlations are different by breed and for virgin heifer, 1st and 2nd lactation cows. $h^2_{\text{(number of inseminations (female))}} = 0.025$ to 0.05 $h^2_{\text{(calving to first insemination (female))}} = 0.03$ to 0.04 $h^2_{\text{(heath strength (female))}} = 0.02$ to 0.025 $r_{g\text{(number of inseminations (virgin heifer, 1st, 2nd lact))}} = 0.40$ to 0.65 $r_{g\text{(calving to first insemination (1st, 2nd lact))}} = 0.75$ to 0.99 $r_{g\text{(heath strength (virgin heifer, 1st, 2nd lact))}} = 0.45$ to 0.67 $r_{g\text{(calving to first insemination, heat strength)}} = 0.40$ to 0.81
Sire categories	AI-bulls

Environmental effects
   pre-adjustment
   evaluation model
	All missing heat records are treated as "clear"
	Herd x year, year x month, breed of dam

Base for age adjustment	None
Use of genetic groups and/or relationships	No genetic groups. Relationship matrix considering sire and MGS of the bull is used
Method (model) of genetic evaluation	ST BLUP SM
System validation	Control checking of correlations between bullsires and their son groups

Reproduction fertility traits *continued*	Insemination number (female) Calving to first insemination interval (female) Heat strength (female)
Expression of proof	Standardized RBV with M = 100 and SD $\approx$ 6, higher values are more desirable There are in total 12 single and combined RBV's Fertility index: - 959 x number of inseminations$_{heifer}$ - 725 x number of inseminations$_{1st\ lactation}$ - 841 x number of inseminations$_{2nd\ lactation}$ - 632 x heat strength$_{heifer}$ - 452 x heat strength$_{1st\ lactation}$ - 524 x heat strength$_{2nd\ lactation}$ - 8.5 x calving to first insemination interval$_{1st\ lactation}$ - 18.3 x calving to first insemination interval$_{2nd\ lactation}$
Genetic (reference) base	Rolling average RBV of the last three years of tested bulls
Criteria for official publication of sire proofs	$\geq$ 70 effective heifers
Number of evaluations/ publications per year	Two; January, July
Use in total merit index	Included, see page 131
Key reference on methodology applied	Report 45 from the Department of Animal Breeding and Genetics. Swedish University of Agricultural Sciences. S-75007 Uppsala, Sweden

Health traits	a)	Clinical mastitis
	b)	Somatic cell count
	c)	Resistance against other diseases

Breed(s)	a-c)	Swedish Friesian, Swedish Red & White
Trait definition and unit(s) of measuring	a)	Scored in 2 categories; no mastitis (0), mastitis (1). Diagnosis from 10 days before 1st calving to 150 days after 1st calving
	b)	Lactation mean of log 10 transformed somatic cell count (in 10,000/ml)
	c)	Scored in 2 categories; no treatment (0), treatment (1). Diagnosis from 10 days before 1st calving to 150 days after 1st calving of other diseases than mastitis, treated as one trait. Other diseases are ketosis, retained placenta, paresis, teat injuries, leg & foot diseases, infectious and metabolic disorders
Method of measuring and collecting data	a)	Reports from veterinarians, culling reports from milkrecording
	b)	Lab analysis from the milk recording scheme
	c)	Reports from veterinarians, registration concerning fertility treatments by AI-technicians and culling reports from milk recording
Time period for data inclusion	a-c)	Since 1983
Age groups	a-c)	1st lactation, calving age between 22 and 36 months
Genetic parameters	a)	$h^2_{clinical\ mastitis} = 0.02$
	b)	$h^2_{somatic\ cellcount} = 0.08$
	c)	$h^2_{resistance\ against\ other\ diseases} = 0.02$
Sire categories	a-c)	AI-bulls
Environmental effects pre-adjustment	a-c)	None
evaluation model	a-c)	Herd x year x season, calving month, calving age, breed of dam
Base for age adjustment	a-c)	None
Use of genetic groups and/or relationships	a-c)	No genetic groups. Relationship matrix considering S and MGS of the bull
Method (model) of genetic evaluation	a-c)	ST BLUP SM Clinical mastitis and somatic cell count are evaluated separately, and weighted by SI using economic weights and $r_{g(clinical\ mastitis,\ somatic\ cellcount)} = 0.70$
System validation	a-c)	Control of correlation between RBV based on bulls 1st daughter group resp 2nd daughter group

Health traits *continued*	a)	Clinical mastitis
	b)	Somatic cell count
	c)	Resistance against other diseases

Expression of proof	a-c)	Standardized RBV with M = 100 and $SD_{index} \approx 5$, higher values are more desirable
	a,b)	Mastitis resistance index, somatic cell count is used as a correlated trait (index weight = 0) to increase (by 10 to 15%) accuracy of the prediction of clinical mastitis resistance.
Genetic (reference) base	a-c)	Rolling average RBV of the last three years of tested bulls
Criteria for official publication of sire proofs	a-c)	≥ 70 effective daughters
Number of evaluations/ publications per year	a-c)	Two; January, July
Use in total merit index	a-c)	Included, see page 131
Key reference on methodology applied	a-c)	Report 73 from the Department of Animal Breeding and Genetics. Swedish University of Agricultural Science. S-75007 Uppsala, Sweden

SWEDEN

Workability traits	Milking speed Leakage Temperament

Breed(s)	Swedish Friesian, Swedish Red & White
Trait definition and unit(s) of measuring	Milking speed is scored from slow (1) to fast milking (9) Leakage is scored in 2 categories; occurring or not occurring Temperament is scored from extremely nervous (1) to easy to handle (9) during milking/in shed
Method of measuring and collecting data	Scored by farmer and collected by classifiers
Time period for data inclusion	Since 1993
Age groups	1st lactation, calving age between 22 and 36 months and classifications between 30 to 270 days post calving
Genetic parameters	$h^2_{milking\ speed} = 0.25$ $h^2_{leakage} = 0.10$ $h^2_{temperament} = 0.15$
Sire categories	AI-bulls
Environmental effects pre-adjustment evaluation model	None Classifier x year, calving age, classification month, lactation stage, time of visit (hours post milking, not for temperament)
Base for age adjustment	None
Use of genetic groups and/or relationships	Genetic groups by national or foreign origin. Relationship matrix considering three generations besides the animal evaluated
Method (model) of genetic evaluation	ST BLUP AM
System validation	-
Expression of proof	Standardized RBV with M = 100 and $SD_{index} \approx 5$, higher values are more desirable
Genetic (reference) base	Rolling average RBV of the last three years of tested bulls
Criteria for official publication of sire proofs	≥ 35 daughters
Number of evaluations/ publications per year	Five; January, April, July, September, November
Use in total merit index	Temperament is included in total merit index, see page 131. Economic weight is 0.15 when RBV is above 100, and 0.30 when RBV is below 100
Key reference on methodology applied	-

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Conformation traits	Udder:	fore udder attachment, rear udder height, rear udder width, udder cleft, udder depth, udder balance, front teat placement, teat length, floor to udder distance, leakage, extra teats, udder oedema
	Locomotion:	rear leg set, legs rear view, foot angle, rear leg quality, bone quality (flatness of bone)
	Other:	stature, dairy form, strength, body depth, thurl width, rump angle, back line

Breed(s)	Swedish Friesian, Swedish Red & White
Trait definition and unit(s) of measuring	Scored on a linear 1-9 point scale, front teat placement, teat length, floor to udder distance and stature are also measured in cm
Method of measuring and collecting data	Scored by classifiers
Time period for data inclusion	Since 1993
Age groups	1st lactations, calving age between 22 and 36 months and classifications between 30 to 270 days post calving
Genetic parameters	$h^2_{udder\ traits} = 0.15$ to 0.35 $h^2_{locomotion\ traits} = 0.10$ to 0.20 $h^2_{other\ traits} = 0.10$ to 0.35
Sire categories	AI-bulls
Environmental effects pre-adjustment evaluation model	None Udder traits: Classifier x year, calving age, classification month, lactation stage, time of visit (hours post milking) Locomotion and other traits: Classifier x year, calving age, classification month, lactation stage
Base for age adjustment	None
Use of genetic groups and/or relationships	Genetic groups by national or foreign origin. Relationship matrix considering three generations besides the animal evaluated
Method (model) of genetic evaluation	ST BLUP AM
System validation	-

| Conformation traits
continued | Udder
Locomotion
Other |
|---|---|
| **Expression of proof** | Standardized RBV with M = 100 and $SD_{index} \approx 5$
Udder index: 0.20 x fore udder attachment + 0.05 x rear udder width + 0.20 x udder cleft + 0.20 x front teat placement + 0.20 x teat length + 0.20 x floor to udder distance + 0.1 x udder remarks.
Leg index: 0.05 x rear leg set + 0.30 x leg rear view + 0.20 x foot angle + 0.30 x rear leg quality + 0.15 x remarks
Body index: 0.25 x stature + 0.10 x dairy form + 0.15 x strength + 0.10 x body depth + 0.15 x thurl width + 0.15 x rump angle + 0.05 x back line + 0.05 x body remarks.
NB: each trait is deviated from an optimum and RBV is calculated |
| **Genetic (reference) base** | Rolling average RBV of the last three years of tested bulls |
| **Criteria for official publication of sire proofs** | ≥ 35 daughters (≥ 25 daughters for measured traits) |
| **Number of evaluations/ publications per year** | Five; January, April, July, September, November |
| **Use in total merit index** | Included, see page 131 |
| **Key reference on methodology applied** | - |

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Longevity traits	Survival
Breed(s)	Swedish Friesian, Swedish Red & White
Trait definition and unit(s) of measuring	The cows ability to survive different time periods: first lactation, 150 days after second calving, second lactation Survival is scored as a dead (0) or alive (1)
Method of measuring and collecting data	Calculated from birth and culling records in the milk recording scheme
Time period for data inclusion	Since 1982
Age groups	Animals from birth to 2nd lactation, calving age between 22 and 36 months
Genetic parameters	$h^2_{survival} = 0.02$
Sire categories	AI-bulls
Environmental effects pre-adjustment	Records in progress are given an average probability of surviving actual time period. Consideration is given to how many months remaining to end of period
evaluation model	Herd x year x season, calving month, calving age, breed of dam
Base for age adjustment	None
Use of genetic groups and/or relationships	No genetic groups, no relationship matrix
Method (model) of genetic evaluation	ST BLUP SM
System validation	-
Expression of proof	Standardized RBV with M = 100 and $SD_{index} = 5$, higher values are more desirable
Genetic (reference) base	Rolling average RBV of the last three years of tested bulls
Criteria for official publication of sire proofs	≥ 70 effective daughters which have survived 1st lactation
Number of evaluations/ publications per year	Two; January, July
Use in total merit index	No
Key reference on methodology applied	-