**Supplementary Table S5.** Heritability estimates (standard error in parenthesis) for male fertility traits†.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ScrotalCircum | Sperm conc | Sperm motility | Percent live sperm | Sperm number | Volume | Abnormalities/normal | Non-return rate | Calving rate | Country | Reference |
|  |  |  |  |  |  |  | 0.001(0.001) |  | Ireland | Berry et al. (2011) |
| 0.53 (0.06) |  |  |  |  |  |  |  |  | US | Bourdon and Brinks (1986) |
| 0.75 (0.09) |  | 0.24 (0.07) |  |  |  | 0.25(0.09) |  |  | Australia | Corbet et al. (2013) |
| 0.43 (0.09) |  | 0.13 (0.05) |  |  |  | 0.20(0.06) |  |  | Australia | Corbet et al. (2013) |
|  | 0.37 (0.22) | 0.51 (0.26) |  |  | 0.53 (0.27) |  |  |  | Canada | Diarra et al. (1997) |
|  | 0.37 (0.09) | 0.23 (0.08) |  |  | 0.65 (0.09) | 0.19(0.07) |  |  | France | Ducrocq and Humblot (1995) |
| 0.57 (0.03) |  |  |  |  |  |  |  |  | Brazil | Eler et al. (2004) |
| 0.714 (0.132) |  |  |  |  |  |  |  |  | New Mexico | Evans et al. (1999) |
| 0.46 (0.08) |  | 0.05 (0.03) |  |  |  | 0.25(0.07) |  |  | US | Garmyn et al. (2011) |
| 0.51 (0.09) | 0.2 (0.13) | 0.11 (0.12) |  | 0.19 (0.14) |  |  |  |  |  | Gipson et al. (1987) |
|  | 0.14 (0.04) | 0.04 (0.01) | 0.1 (0.05) | 0.22 (0.02) | 0.18 (0.02) |  |  |  | Austria | Gredler et al. (2007) |
|  | 0.26 |  |  |  | 0.04 |  |  |  |  | Kaps et al. (2000) |
| 0.57 (0.09) | 0.16 (0.08) | 0.22 (0.09) | 0.22 (0.09) |  | 0.09 (0.08) | 0.35(0.10) |  |  | US | Kealey et al. (2006) |
| 0.36 (0.06) | 0.13 (0.06) | 0.13 (0.06) |  | 0.24 (0.05) |  |  |  |  | US | Knights et al. (1984) |
|  |  |  |  |  |  |  | 0.0002 |  | US | Kuhn and Hutchison (2008) |
|  |  |  |  |  |  |  |  | 0.08 | Australia | Mackinnon et al. (1990) |
| 0.41 (0.05) |  |  |  |  |  |  |  |  | US | Martínez-Velázquez et al. (2003) |
|  | 0.52 | 0.31 |  | 0.38 | 0.24 |  |  |  | Canada | Mathevon et al. (1998a) |
|  | 0.36 | 0.01 |  | 0.54 | 0.44 |  |  |  | Canada | Mathevon et al. (1998a) |
|  | 0.32 |  |  | 0.15 | 0.08 |  |  |  | France | Mathevon et al. (1998b) |
| ScrotalCircum | Sperm conc | Sperm motility | Sperm number | Volume | Abnormalities/normal | Non-return rate | Country | Reference |
| 0.42 (0.0002) |  |  |  |  |  |  | Brazil | Silva et al. (2011) |
|  | 0.21 | 0.37 | 0.26 | 0.29 |  |  | Ukraine | Siratskii (1990) |
| 0.4 (0.09) |  |  |  |  | 0.07 (0.06) |  | US | Smith et al. (1989) |
|  |  |  |  |  |  | 0.002 (0.0015) | Sweden | Stålhammer et al. (1994) |
|  | 0.1 |  | 0.03 | 0.18 |  |  | US | Taylor et al. (1985) |

† Scrotal Circum= scrotal circumference; Sperm conc = sperm concentration

**References.**

Berry DP, Evans RD and McParland S. 2011. Evaluation of bull fertility in dairy and beef cattle using cow field data. Theriogenology 75, 172-181**.**

Bourdon RM, and Brinks JS. 1986. Scrotal circumference in yearling Hereford bulls: Adjustment factors, heritabilities and genetic, environmental and phenotypic relationships with growth traits. Journal of Animal Science. 62,958–967

Corbet NJ, Burns BM, Johnston DJ, Wolcott ML, Corbet DH, Venus BK, Li Y, McGowan MR, and Holroyd RG. 2013. Male traits and herd reproductive capability in tropical beef cattle. 2. Genetic parameters of bull traits. Animal Production Science, 53, 101-113

Diarra MS, Pare, JP, and Roy G. 1997. Genetic and environmental factors affecting semen quality of young Holstein bulls. Canadian Journal of Animal Science. 77, 77–85.

Ducrocq V and Humblot P. 1995. Genetic characteristics and evolution of semen production of young Normande bulls. Livestock Production Science. 41, 1–10.

Eler JP, Silva JA, Evans JL, Ferraz JB, Dias F, and Golden BL. 2004. Additive genetic relationships between heifer pregnancy and scrotal circumference in Nellore cattle. Journal of Animal Science. 82, 2519–2527

Evans JL, Golden BL, Bourdon RM, and Long KL. 1999. Additive genetic relationship between heifer pregnancy and scrotal circumference in Hereford cattle. Journal of Animal Science. 77, 2621–2628.

Garmyn AJ, Moser DW, Christmas RA, and Minick Bormann J. 2010. Estimation of genetic parameters and effects of cytoplasmic line on scrotal circumference and semen quality traits in Angus bulls. Journal of Animal Science. 89, 693–698.

Gipson DW, Vogt DW, Massey JW, and Ellersieck MR. 1985. Associations of scrotal circumference with semen traits in young bulls. Theriogenology 24, 217–225.

Gredler B, Fuerst C, Fuerst-Waltl B, Schwarzenbacher H, Sölkner J, 2007: Genetic parameters for semen production traits in Austrian dual-purpose Simmental bulls. Reproduction in Domestic Animals 42, 326–328.

Kealey CG, Macneil MD, Tess MW, Geary TW, and Bellows RA. 2006. Genetic parameter estimates for scrotal circumference and semen characteristics of Line 1 Hereford bulls. Journal of Animal Science. 84, 283–290.

Knights SA, Baker RL, Gianola D, and Gibb JB. 1984. Estimates of heritabilities and genetic and phenotypic correlations among growth and reproductive traits in yearling Angus bulls. Journal of Animal Science. 58, 887–893.

Kuhn MT, and Hutchison JL. 2008 Prediction of dairy bull fertility from field data: use of multiple services and identification and utilization of factors affecting bull fertility. Journal of Dairy Science. 91, 2481-2492

Mackinnon MJ, Taylor JF AND Hetzel DJS 1990. Genetic variation and covariation in beef cow and bull fertility Journal of Animal Science. 68, 1208-1214.

Martínez-Velázquez G, Gregory KE, Bennet GL, and Van Vleck LD. 2003. Genetic relationships between scrotal circumference and female reproductive traits. Journal of Animal Science. 81, 395–401

Mathevon M, Buhr MM, and Dekkers JCM, 1998a. Environmental, management, and genetic factors affecting semen production in Holstein bulls. Journal of Dairy Science. 81, 3321 – 3330.

Mathevon M, Dekkers JCM, Buhr, MM. 1998b. Environmental, management and genetic factors affecting semen production in French Montbéliard bulls. Livestock Production Science. 55, 65-77.

Silva MR, Pedrosa VB, Silva JCB, Eler JP, Guimarães JD and Albuquerque LG. 2011. Testicular traits as selection criteria for young Nellore bulls. Journal of Animal Science. 89, 2061–2067

Siratskii IZ. 1990. Inheritance of reproductive ability of bulls. Tsitol. Genet. 24: 28-34

Smith BA, Brinks JG, and Richardson GV. 1989. Estimation of genetic parameters among breeding soundness examination components and growth traits in yearling bulls. Journal of Animal Science. 67:2892–2896.

Stålhammer E-M, Janson L, and Philipsson J. 1994. Genetic studies on fertility in AI bulls. II. Environmental and genetic effects on non-return rates of young bulls. Animal Reproduction Science. 34, 193-207.

Taylor JF, Everett RW, Beam B. 1985 Systematic environmental, direct, and service sire effects on conception rate in artificially inseminated Holstein cows. Journal of Dairy Science. 68, 3004-3022.