ABSTRACT: Age at first calving is the standard fertility trait for dairy heifers. This trait is affected by growth rate and the managers’ attitude towards an early age at first calving. While age at conception for heifers could be derived from age at first calving, little information is available on the age at first service in heifers and first service success rate. Service records from 13072 heifers in 16 South African Holstein and Jersey herds were available. Average (±SD) age at first service for Holstein and Jersey heifers was 19.3±4.8 and 16.8±8.1 months of age respectively. The percentage of first services being done before 15 months of age for Holstein heifers varied from zero to 31% between herds while for Jersey heifers this also varied from zero to 83%. The result is a high age at first calving, i.e. 29.4±5.2 and 26.4±8.6 months of age for Holstein and Jersey heifers respectively. Some effort should be put into improving reproduction performance of heifers to reduce rearing costs.

Keywords: dairy heifers fertility traits; conception age; days open.

Introduction
Rearing replacement heifers is an important component of the husbandry and genetic improvement of a dairy herd. Generally it is recommended that replacement heifers should calve down to enter the milking herd at 22 to 24 months of age (Heinrichs and Swartz (1990) and Crowley et al. (1991)). Hoffman and Funk (1992) noted that although both lifetime yield and profitability data support a first calving at or near 24 months of age, the adoption of this recommendation had been slow in United States (US) dairy breeds. Mean ages at first calving was 28.6, 27.8, 27.4, 27.3, 27.8 and 25.9 months for Ayrshire, Brown Swiss, Guernsey, Holstein, milking shorthorn and Jersey heifers respectively (Powell, (1985)). The growing dairy heifer represents approximately 25% of the feed cost on an animal’s lifetime (Berry (2012)). However, farmers seem to be reluctant to follow an appropriate feeding program to ensure dairy heifers of adequate size at first calving. This can be observed in the late age at first calving, i.e. 28±4 months for South African Holstein heifers (Makgahlela et al. (2007)) and 26±4 months of age for Jersey heifers (du Toit et al. (2012)). A National Dairy Heifer Evaluation Project survey by Heinrichs et al. (1994) indicated that average age at first calving in the US was 25.9 months at an average life weight of 504 kg.

No research has been done in South Africa to determine the effect of poor growth rate on subsequent milk production performance of cows in first and later lactations. Mostert et al. (2001) found that cows calving down at a younger age produced less milk over the entire lactation than cows calving down later. This, however, is to be expected as older heifers would be heavier than heifers calving down earlier. The reproduction performance of heifers has also not received any attention in local research programs. Although the age at conception could be estimated by back-calculation from the age of first calving, this, however, does not give any indication of age at first service, the success of first service conception and general reproductive performance of dairy herds. Recently, fertility parameters have been estimated for South African Holstein cows (Muller et al. (2012)). Such an analysis has not yet been done for replacement heifers, the reason for this being a lack of the availability of reproduction records for heifers.

Generally, farmers keep record of all services conducted as this information is being used in the management program of the herd. For heifers the proportion of heifers being artificially inseminated varies with Holstein breeders in intensive production systems making more use of it while Jersey farmers in pasture-based systems tend to use a bull for getting heifers pregnant. The objective of this study was to determine the standard of reproduction management in a number of Holstein and Jersey herds towards the estimation of genetic parameters for fertility traits of replacement heifers.

MATERIALS AND METHODS
Heifer rearing. Dairy heifers are generally raised in the same way, i.e. being kept in individual pens and fed full cream milk or milk replacer twice daily up to weaning at about 2 months of age. An 18% crude protein (CP) calf starter meal is fed from about 7 days of age up to 2 months of age after which a calf growth meal containing 15% CP is fed up to 6 months of age. On pasture-based dairy farms heifers are kept in groups on pasture which is often supplemented with a concentrate mixture at about 1 to 2 kg per day up to 12 months of age. Intensive farming systems make use of total mixed rations formulated according to different age groups. Insemination starts from 12 months of age for Jersey heifers while insemination starts from 14 months of age for Holsteins. In some cases a home-bred bull is kept with the heifers especially from 18 months of age in a continuous mating system. Pregnancy is usually confirmed by rectal palpation by a veterinarian on a monthly visit.

Data. Service records of 10637 Holstein heifers in 11 herds and 2435 Jersey heifers in 5 herds born between 1992 and 2010 were available. The outcome of each service event was known. Service dates were linked to birth dates and pregnancy check results. Fertility traits derived were age at first service and age at first calving and whether age at first calving was before 15 or 18 months of age and whether age at first calving was before 24 or 27 months of age. Non-interval traits were recorded as binary threshold traits coded.
Table 1. Least square means ±SD for reproduction parameters for Holstein and Jersey heifers.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Jerseys</th>
<th>Holsteins</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of records</td>
<td>22435</td>
<td>10637</td>
</tr>
<tr>
<td>AFS (months)</td>
<td>16.8±8.1</td>
<td>19.3±4.8</td>
</tr>
<tr>
<td>FS &lt;15m</td>
<td>0.65±0.48</td>
<td>0.10±0.30</td>
</tr>
<tr>
<td>FS &lt;18m</td>
<td>0.88±0.33</td>
<td>0.47±0.50</td>
</tr>
<tr>
<td>AFC(months)</td>
<td>26.4±8.6</td>
<td>29.4±5.2</td>
</tr>
<tr>
<td>AFC&lt;24m</td>
<td>0.45±0.50</td>
<td>0.07±0.25</td>
</tr>
<tr>
<td>AFC&lt;27m</td>
<td>0.79±0.41</td>
<td>0.36±0.48</td>
</tr>
<tr>
<td>SPC</td>
<td>1.55±0.91</td>
<td>1.50±0.96</td>
</tr>
<tr>
<td>FS success rate</td>
<td>0.64±0.48</td>
<td>0.70±0.46</td>
</tr>
</tbody>
</table>

a,bValues with different superscripts differ at P <0.01; AFS: age at first service; FS: first service; AFC: age at first calving; SPC: services per conception.

RESULTS AND DISCUSSION

Reproduction traits. The average (±SD) reproduction performance of heifers in Holstein and Jersey herds is presented in Table 1. Age at first service for Jersey heifers was earlier than for Holstein heifers, i.e. 16.8±8.1 vs. 19.3±4.8 months of age with a larger proportion of Jersey heifers inseminated before 15 and 18 months of age. Although Holstein heifers had a higher (P<0.01) first service success rate in comparison to Jersey heifers, being 0.70 vs. 0.64 respectively, this did not result in an earlier age at first calving. An earlier AFC for Jerseys 26.4±8.6 vs. 29.4±5.2 months of age for Holstein heifers probably resulted from a shorter breeding period, i.e. first to last service date. The number of services per conception was lower (P<0.05) for Holsteins. In both cases a relatively high (>65%) insemination efficiency was achieved. Tiezzi et al. (2012) showed that the number of SPC for virgin Brown Swiss heifers to be 1.56. The present data set does not give any indication of the number of natural services used to get heifers pregnant. It is expected that natural mating should increase service efficiency as only the last service is recorded by back-calculating once heifers are confirmed pregnant. Natural service is often being used for heifers because of practical reasons. The proportion of heifers being inseminated for the first time within different age group categories is presented in Figure 1 indicating large differences between breeds with 83% of Jersey heifers first inseminated before 16 months of age compared to only 21% for Holstein heifers. For an early age at first calving heat detection for first insemination should probably start from 13 months of age as most (>85%) of heifers should be confirmed pregnant by 15 months of age. Mostert et al. (2001) also concluded that Jersey breeders tend to breed heifers earlier than Holstein breeders because 19% of Jersey heifers calved down before 26 months of age in comparison to 9% for Holstein heifers. Tiezzi et al. (2012) showed that fertility in Brown Swiss heifers is a different trait to fertility in lactating cows and could therefore not be used as a robust indicator of mature cow fertility. Although the present data set has no information available on the live weight of heifers, it is to be expected that the age at first service could be affected by growth rate with Jersey heifers reaching sexual maturity earlier than Holstein heifers. Lee et al. (1988) noted that there substantial additive genetic differences between dairy breeds and sire groups within breeds for size and growth rate of replacement heifers. The effect of live weight of heifers at first service and conception in relation to breed mature live weights would give some indication of fertility performance.

Figure 1. The distribution of the age of first service for Holstein and Jersey heifers.

Conclusion

Breed differences in fertility traits were observed with Jersey heifers being inseminated earlier than Holstein heifers. First service success rate and number of services per conception differed although in absolute values differences were small. An earlier start to first insemination resulted in an earlier age at first calving. The availability of service records for heifers provides the opportunity to derive genetic parameters for fertility traits for heifers. The proportion of first services done before 15 months of age in heifers could be used as a management tool to assess the efficacy of heifer rearing practices. This data set could provide a benchmark tool for farmers. Further studies are envisaged to derive genetic parameters for heifer fertility traits.

Literature Cited