REPRODUCTIVE PERFORMANCE OF HOLSTEIN AND JERSEY HEIFERS AND COWS IN A PASTURE-BASED SYSTEM IN SOUTH AFRICA

C.J.C. Muller[1], J.P. Potgieter[2], S.W.P Cloete[1,2] and J.A. Botha[1]

[1]Western Cape Department of Agriculture, Research & Technology Development Services, Directorate: Animal Sciences, Private bag X1, Elsenburg 7607, South Africa;
[2]Department of Animal Sciences, University of Stellenbosch, Stellenbosch 7600, South Africa

SUMMARY

The fertility in dairy cows is a major issue, as several studies suggest declines in the reproductive performance of dairy cows over the past 20 years. Little information is available on the comparative performance of South African Holstein (H) and Jersey (J) cows under similar feeding and management conditions. In this paper, the reproductive performance of H (n=120) and J (n=126) heifers and lactating cows on mostly kikuyu pasture are presented. Cows were supplemented with the same concentrate mixture after milking at 7 kg per cow per day. On average (±s.d.), Jersey heifers were inseminated earlier ($P<0.05$) than H heifers at 15.4±2.1 and 16.1±2.3 months of age, respectively. A higher ($P<0.05$) ratio of J heifers were inseminated for the first time by 15 months of age than H heifers (0.49 vs. 0.29). Fertility traits, calving to first service (CFS), first service within 80 days post partum (FS<80d), and cows confirmed pregnant within 100 days post partum (PD100d) for H and J cows were 88±26 and 78±29 days ($P<0.01$), 0.44 and 0.62 ($P<0.01$) and 0.31 and 0.51 ($P<0.05$) respectively. The interval from calving to conception differed ($P<0.05$) between breeds, being 119±61 and 138±62 for J and H cows respectively Results are consistent with other studies showing a higher conception rate in J cows compared to H cows. The poorer reproductive performance of H could be probably attributed to a greater potential for milk production. Further studies are foreseen comparing the production performance and efficiency of H and J cows under this feeding regime.

INTRODUCTION

The declining fertility of dairy cows has recently become a major issue in most of the main dairy producing countries in the world. In most countries selection is aimed at improving milk production performance and conformation traits. Studies have shown that the declining reproductive performance of dairy cows may be associated to an increasing proportion of North American H sires in national dairy herds (Auldist, *et al*. 2007; Buckley, *et al*. 2003). Because of this decline in fertility in Holstein cows, producers are considering using other breeds, or in some cases, doing crossbreeding to improve traits such a fertility. In South Africa, the J breed is becoming very popular, especially in pasture-based areas. The breed is also increasingly being used in crossbreeding programmes in countries with seasonal pasture-based production systems mostly because of its perceived better reproductive performance in comparison to H cows (Auldist *et al*. 2007). However, Washburn *et al*. (2002a) found in a survey in the USA, an unexpected close similarity between H and J herds for services per conception or conception rate. This differed from earlier work by Fonseca *et al*. (1983) who reported significant differences in first service conception rate, i.e. 72% for J and 49% for H. Washburn *et al*. (2002b) later found that J cows, when managed in the same herd over three years, had a higher conception rate than H cows, being 59.6% *vs*. 49.5%. In contrast, Prendiville *et al*. (2011) found no significant differences in reproductive efficiency between Holstein-Friesian and J cows in a seasonal pasture-based management system in Ireland. Breed differences in the fertility of South African heifers were demonstrated in a survey involving 10721 H heifers in 11 herds and 2349 J heifers in 5 herds

(Muller *et al*. 2014a). Because of a lack of a national data base for insemination or service records and pregnancy check results for dairy cows in South Africa, calving interval (CI) is at present being used as an indicator for fertility. Genetic parameters have been estimated for calving interval (CI) for dairy breeds (Mostert *et al*. 2010). Phenotypically, a small difference in CI was shown between H and J cows, being 398±68 and 389±64 days, respectively. Heritability estimates for CI were low, being 0.022±0.006 and 0.026±0.004 for J and H, respectively, albeit in agreement with other analyses. Mostert *et al*. (2010) found that genetic trends for CI showed an upward curve since 1980, amounting to 1.25 and 0.50 days per year for H and J cows, respectively. Muller *et al*. (2014b) showed that herd (presumably an indicator of managerial and inseminator skills) had the largest effect on the standard of reproduction management in H cows. The aim of the paper is to compare the reproductive performance of H and J heifers and cows under the same feeding and management conditions in a pasture-based feeding system in South Africa.

MATERIAL AND METHODS

Location and Animals. This paper was based on an on-going breed comparison study being conducted at the Elsenburg Research Farm of the Western Cape Department of Agriculture. Elsenburg is situated approximately 50 km east of Cape Town in the winter rainfall region of South Africa. The area has a typical Mediterranean climate with short, cold, wet winters and long, dry summers. Holstein and J cows have been managed since 2003 as one herd. Cows in milk were supplemented with a commercial concentrate mixture being fed after each milking twice a day for a total of 7 kg per day regardless of milk yield and lactation stage. Cultivated pasture consists mainly of kikuyu grass (*Pennisetum clandestimum*) being irrigated during summer. Cows were on kikuyu pasture during most of the year. Pasture was further supplemented during winter with a pasture replacement mixture consisting of lucerne hay, oat hay and soybean meal providing at least 15% CP on an "as is" basis. Fresh drinking water was freely available at all times.

Data recording. Cows were routinely checked and treated by a veterinarian for retained placentas and uterine infections within the first 10 days after each calving. From 40 days after calving, cows were checked for signs of heat and if active, a tail-marker was put on each cow to facilitate heat detection. Cows not showing signs of reproduction activity at this stage were treated according to a standard hormonal programme. Heat detection was done on a daily basis. Cows were inseminated from about 60 days after calving. Heifers born from these cows were put in a heifer-service group once they reached 13 months of age and were checked for reproductive activity. Heifers were serviced when showing clear signs of being in heat. The reproductive performance of heifers and cows was determined based on service dates and the results of pregnancy detection by rectal palpation by a veterinarian at least 45 days after the last service. Reproductive traits determined for cows were the interval (number of days) from calving to first service (CFS), number of services per conception (SPC), interval from calving to conception (DO), whether first service occurred within 80 days post partum (FS<80d), whether cows became pregnant from first service (PDFS) or within 100 (PD100d) or 200 days (PD200d) after calving. Reproduction traits determined for heifers were age at first service (AFS), whether first insemination of heifers was before 15 months of age, conception age of heifers and whether heifers became pregnant before 15 months of age as well as age at first calving (AFC). Categorical traits were scored as 1 for no and 2 for yes.

Statistical analyses. Reproductive traits for heifers and cows were compared between breeds by analysis of variance using SAS. Records within breeds were used as random replicates. For categorical traits, frequency tables and Chi-square tests were used to determine whether response is independent of breed. Significance was declared at $P<0.05$.

RESULTS AND DISCUSSION

Results from the analysis of variance comparing the reproductive performance of H and J heifers and cows are reported in Table 1. Jersey heifers were inseminated earlier (P<0.05) than H heifers, i.e. at 15.4±2.1 and 16.1±2.3 months of age resulting in a higher ratio (P<0.05) of J heifers inseminated for the first time by 15 months of age. The interval CFS was shorter (P<0.05) for J cows in comparison to H cows, being 78±29 vs. 88±27 days, respectively. This resulted in a higher ratio (P<0.05) of J cows being inseminated within 80 days after calving than H cows, i.e. 0.61 vs. 0.44 respectively. While the number of services per conception for J cows only tended (P=0.09) to be less than for H cows, the interval from calving to conception was shorter (P<0.01) for J cows in comparison to H cows, being 119±61 *vs.* 139±62 days respectively. Although average values for some traits were acceptable, large variations were observed as indicated by high standard deviations. The coefficients of variation ranged from 31 to 51% for CFS and DO respectively. The distribution of the number of DO records is shown in Figure 1. The DO interval of more than 100 days is exceeded in 70 and 50% of lactations for H and J cows respectively.

Table 1. Analysis of variance mean (±s.d) estimates of the reproductive performance of Holstein and Jersey heifers and cows in a pasture-based feeding system (AI = artificial insemination; AFC = age at first calving; FS = first service; CFS = calving to first service; DO = days open; DIM = days in milk)

	Heifers			Cows	
Variables	Holstein	Jersey	Variables	Holstein	Jersey
Number of records	120	126	Number of lactations	326	325
Age first service (m)	16.1[a]±2.3	15.4[b]±2.1	Lactation number	2.31±1.44	2.56±1.51
First service <15m	0.29[a]	0.49[b]	Interval CFS (days)	88[a]±27	78[b]±29
AI's per conception	1.86±1.30	1.77±1.08	FS<80 DIM	0.44[a]	0.61[b]
Pregnant first service	0.54	0.56	Services/conception	2.19±1.41	1.98±1.32
Conception age (m)	17.5[*] ±2.9	16.8[*] ±2.8	Pregnant FS	0.41	0.48
AFC (m)	26.5±2.9	26.1±2.9	Interval DO (days)	139[a]±62	119[b]±61
AFC <24m	0.20	0.28	Pregnant <100 DIM	0.31[a]	0.51[b]
AFC <27m	0.64	0.69	Pregnant <200 DIM	0.85	0.87

[a,b]Values with different superscripts differ at P<0.05; *Values differed at P=0.07

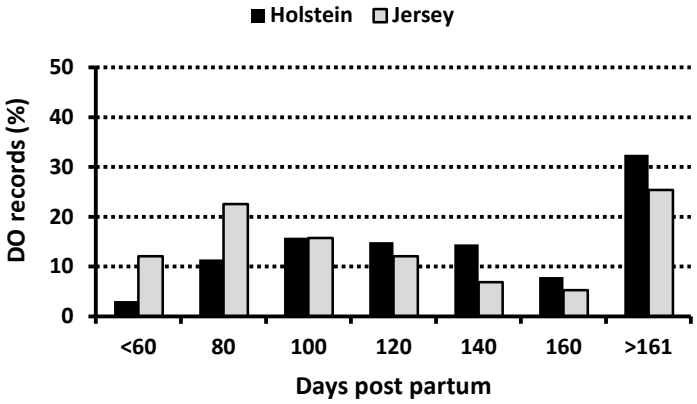

Figure 1. The distribution of the number of records for interval from calving to conception (DO) for all Holstein and Jersey cows

Results are consistent with other studies showing a higher conception rate in J cows in comparison to H cows. The poorer reproductive performance of H could possibly be attributed to a greater potential for milk production. According to an Australian survey (Little, 2003), the observed level of reproductive performance would suggest management problems for both breeds in this study. The 100-day-in-calf rate for H cows was 31% while for J cows 51% was achieved. Mackey *et al*. (2007) reported that in 19 Holstein-Friesian dairy herds in Ireland, fertility performance was generally poor, with the interval to first service being 84.4±35.4 days and the first insemination success rate 40.6±0.68%. The 100-day in-calf rate was 46.0±0.68% and the CI 404±65 days. Growth rate and fertility of heifers are important traits affecting age at first calving and lifetime performance (Cooke *et al*. 2013). More emphasis should be put on the lifetime performance of dairy cows, i.e. total production per day of life from birth, as this would have a greater economic and environmental benefit (Wathes *et al*. 2014).

CONCLUSION

This study reported breed differences in reproduction performance between H and J heifers and cows. Results are consistent with other studies showing a higher conception rate in J cows compared to H cows. Although a larger proportion of J heifers were inseminated before 15 months of age, age at first calving was the same for H and J heifers probably indicating a lack in inseminator proficiency. A larger ratio of H heifers calved down past 27 months of age. First insemination after calving was earlier for J cows compared to H cows, while a higher first service success rate resulting in more J cows confirmed pregnant by 100 days post partum. This translated to fewer days open which should reduce calving interval by approximately 16%. Although J heifers and cows showed a better fertility, a general improvement in reproduction management is required in both breeds. Farmers recognize the importance of fertility in heifers and cows although not using appropriate indicators. Fertility indicators used in the study and results could be used as benchmarks for South African dairy farmers.

ACKNOWLEDGEMENTS

This research was partly funded by the Western Cape Agricultural Research Trust. The efforts of the management team at the Elsenburg dairy are greatly appreciated.

REFERENCES

Auldist M.J., Pyman M.F.S., Grainger C. and Macmillan K.L. (2007). *J. Dairy Sci*. **90**: 4856.
Buckley F.K., O'Sullivan J.F., Mee J.F., Evans R.D. and Dillon P. (2003). *J. Dairy Sci*. **86**: 2308.
Cooke J.S., Cheng Z., Bourne N.E. and Wathes D.C. (2013). Open Access J. Anim. Sci. **3**: 1. http://dx.doi.org/10.4236/ojas.2013.31001.
Fonseca F.A., Britt J.H., McDaniel B.T., Wilk J.C. and Rakes A.H. (1983). *J. Dairy Sci*. **66**: 1128.
Little S. (2003). The InCalf Book for dairy farmers. Dairy Australia.
Mackey D.R., Gordon A.W., McCoy M.A., Verner M. and Mayne C.S. (2007). *Animal*. **1**: 29.
Mostert B.E., Van der Westhuizen R.R. and Theron H.E. (2010). *SA J. Anim. Sci*. **40**: 156.
Muller C.J.C., Potgieter J.P. and Cloete S.W.P. (2014a). *Proc. 10th WCGALP*. p. 640.
Muller C.J.C., Potgieter J.P., Cloete S.W.P. and Dzama K. (2014b). *SA J. Anim. Sci*. **44**: 54.
Prendeville R., Shalloo L., Pierce K.M. and Buckley F. (2011). *Irish J. Agric. Food Sci*. **50**: 123.
Washburn S.P., Silvia W.J., Brown C.H., McDaniel B.T. and McAllister A.J. (2002a). *J. Dairy Sci*. **85**: 244.
Washburn S.P., White W.J., Green J.T. and Benson G.A. (2002b). *J. Dairy Sci*. **85**: 105.
Wathes D.C., Pollott, G.E., Johnson K.F., Richardson, H. and Cooke J.S. (2014). *Animal*. **8:s1**: 91.