
THE PROCEEDINGS OF THE
NEW ZEALAND SOCIETY
OF
ANIMAL PRODUCTION
VOLUME 62 2002

Comparative dairy production of Jerseys and Friesians

A.M. BRYANT, M.A.S. COOK AND K.A. MACDONALD

Ruakura Animal Research Station
Ministry of Agriculture and Fisheries, Hamilton

ABSTRACT

Eight herds each of 24 Friesian cows were stocked at 3.7 cows/ha on separate farmlets during 1982-83 and 1983-84. Annual production per hectare averaged 710 kg fat, 537 kg protein, 740 kg lactose and 16.7 t solids corrected milk (SCM). Annual DM intake was 15.8 t/ha and live weight (LW) during lactation, 1487 kg/ha.

In a contemporary farmlet trial at an adjoining dairy, 4 purebred Jersey herds each of 15 cows were stocked at 2.8, 3.3, 3.8 and 4.3 cows/ha. Regression analysis was used to derive estimates of the performance of the Jerseys at the same stocking rate, and at a stocking rate that resulted in the same LW/ha, as the Friesians.

At a common stocking rate of 3.7 cows/ha, the Friesians were estimated to produce 7, 15, and 13% more fat, protein, and SCM/ha than the Jerseys. Annual conversion efficiency (g milk constituent/kg DM) of the Friesians was estimated to be 10% higher for fat and 18% higher for milk solids than the Jerseys.

At the same LW/ha, requiring a Jersey stocking rate of 4.21 cows/ha, the Friesians were estimated to outproduce the Jerseys by 3, 13 and 10% for fat, protein and SCM/ha respectively. Annual conversion efficiency for the Friesians was estimated to be 15 and 25% higher for fat and milk solids respectively than for the Jerseys.

For Jerseys, estimated maximum yields per hectare of milkfat and milk solids were at 4.45 and 4.37 cows/ha and were 686 kg fat/ha and 1761 kg milk solids/ha; 4 and 13% respectively less than produced by the Friesians stocked at 3.7 cows/ha.

The superior production of the Friesians was due to their higher food conversion efficiency, not to higher food intake.

Keywords Dairy cattle; breeds; milk; milk solids; food intake; Jersey; Friesian; efficiency.

INTRODUCTION

There are no published data for New Zealand conditions on the extent that breed of dairy cow influences the yield of milk or milk solids per hectare. There is clear evidence, summarised in Table 1, that Friesian or Friesian cross animals produce more milk per cow, and despite the lower fat content, also more fat than do Jerseys. Of the reports, only that of Campbell (1977) provides information on protein. Compared to their Jersey contemporaries, Friesian cross cows produced milk containing 0.2 percentage units less protein but yielded about 9% more protein per cow.

The experiment at the Ruakura No. 2 Dairy during the 1982-83 and 1983-84 seasons involved 8 farmlets stocked with Friesians. A separate experiment at the adjoining No. 5 Dairy involved 8 farmlets stocked with Jerseys. This paper uses data from these 2 trials to derive estimates of the comparative per hectare performance of Friesians and Jerseys.

TABLE 1 Per cow performance of Friesians or Friesian crosses and differences between them and Jerseys.

Reference	Breed	Milk F (kg/cow)	Milk (F - J)/J (%)	Fat F (kg/cow)	Fat (F - J)/J (%)	Fat% F (%)	Fat% J - F
NZDB (1954)	J *v* F	3668	39	135	-2	3.69	1.51
Stichbury (1965)	J *v* FJ	-	-	146	9	-	
Quartermain and Carter (1969)	J *v* F	3902	34	158	6	4.11	1.03
Campbell (1977)	J *v* FJ	-	16	-	5	-	0.53
Macmillan *et al.* (1981)	J *v* FX	-	-	174	15	-	
NZDB (1983)	J *v* F	4569	65	189	32	4.14	1.53

EXPERIMENTAL

Friesian Data

Eight herds each of 24 cows and stocked at 3.70 cows/ha provided the Friesian data. Of the 192 cows used each year, 157 in 1982-83 and 173 in 1983-84 were derived from an originally purebred Jersey herd by continuous use since 1968 of New Zealand Dairy Board semen from nominated Friesian sires (Campbell, 1977). They were the daughters of 10 sires. The remainder were cows of unrecorded ancestry added in 1979. Percentage of Friesian blood, percentage of 2 year olds and average breeding index (BI) of the 192 cows were 76, 21 and 123 respectively in 1982-83 and 80, 21, and 126 in 1983-84.

The herds were maintained on their separate farmlets. These were similar in soil and pasture type, and each was divided into 32 paddocks of 0.202 ha. The experimental objective was to determine the effects of contrasting grazing management during April-July on milk solids production per hectare. Management was otherwise common and apart from effects of conservation, involved a grazing interval during lactation of 32 days. Each grazing was of 24 h duration. Amount of silage used during the autumn-winter was also common, being 160 kg DM/cow in both years.

Jersey Data

A contemporary farmlet trial at the adjoining No. 5 Dairy investigated the effects of BI of farm productivity. Four farmlets were stocked with cows with a BI of about 126 and 4 with cows of about 100 BI. Data from only the former farmlets were used in the present analysis. The stocking rates were 2.8, 3.3, 3.8 and 4.3 cows/ha.

Herd size was 15 cows of which 27% were 2 year olds. All cows had at least 3 generations of male ancestry that was pure Jersey. Their average BI was 126 in 1982-83 and 127 in 1983-84 and daughters of 27 sires were involved over the 2 years. Each farmlet consisted of 20 uniformly sized paddocks. Grazing interval was 20 d during lactation except when paddocks were closed for silage.

General

Neither cows nor paddocks were changed among treatments during the 2 years. Planned start of calving for all herds was 15 July with calving being completed in 8 weeks. A series of objective decision rules, aimed at providing optimum management for each stocking rate, determined conservation, drying off, and except for the Friesians, winter grazing management. Winter supplement as silage was fixed at 160 kg DM/cow. Where silage made, less 20% for storage loss, exceeded this, the excess was fed out during the year. Where this amount was not conserved, the deficit was met from other sources.

The Friesians were milked in a 14 a-side herringbone with milk yield and composition determined at 2 consecutive milkings each week. The Jerseys were milked in a 22-stand rotary with milk yield measured at 10 milkings each week. Aliquot samples from 4 consecutive milkings each week were used for determining milk composition.

The Friesians were weighed and condition scored at calving and at fortnightly intervals. This also applied to the Jerseys except that weighing was weekly. Each week herbage mass to ground level on each paddock was estimated by a combination of visual assessment and calibration cuts. Pasture growth rates were calculated from the changes in mass on paddocks not grazed between consecutive assessments. Pasture intake was determined from herbage mass present before and after 3 grazings each week.

Analysis of Data

The performance of the Jerseys was estimated for each of the situations where on a per hectare basis the mean LW, DM intake, fat, protein, fat plus protein plus lactose (F + P + L), solids corrected milk (SCM) and stocking rate was the same as for the Friesians. The stocking rate necessary for the Jerseys to equal the Friesians for each of these variables was calculated from the linear regression of the variable, expressed on a per cow basis, on stocking rate. The values of other variables for these stocking rates were then derived from their individual relationships with stocking rate.

The Friesian data were averaged over the 2 years with the error variance being that due to herds and herd x year interaction.

RESULTS

Effect of Stocking Rate on Jersey Performance

The value of most variables decreased with increasing stocking rate (Table 2). Milk composition and ratio of protein yield to fat yield remained constant. The small effects of stocking rate on LW and condition score immediately after calving indicate the pre-calving feeding levels were similar across stocking rates.

Estimated Performance of Jerseys when Live Weight per Hectare and when Stocking Rate was the Same as the Friesians.

The average of all weighings of the Friesians during lactation was 402 kg, equivalent to 1487 kg/ha. The stocking rate necessary for the LW of the Jerseys to be 1487 kg/ha was estimated as 4.21 cows/ha. Estimated performance of the Jerseys at this stocking

TABLE 2 Change in performance (kg/cow unless indicated) of Jerseys with unit increase in stocking rate.

Variable	Change ± SE	Variable	Change ± SE
Days in milk	− 23 ± 5	Mean LW	− 23 ± 6
Milk	− 610 ± 89	Calving LW	− 19 ± 9
Fat(F)	− 35 ± 4	Calving condition (scores)	− 0.8 ± 0.3
Protein (P)	− 26 ± 3	Silage DM available	− 596 ± 33
Lactose (L)	− 32 ± 5	Ratio P/F	− 0.006 ± 0.002
F + P + L	− 92 ± 10	DM intake	− 367 ± 84
SCM	− 784 ± 83	F/DMI (g/kg)	− 4 ± 1
F%	− 0.003 ± 0.08	(F + P + L)/DMI (g/kg)	− 12 ± 3
P%	− 0.038 ± 0.05	SCM/DMI (g/kg)	− 100 ± 25
L%	− 0.012 ± 0.01		

rate, and at 3.7 cows/ha, the same as the Friesians, is in Table 3. Included is the actual performance of the Friesians.

Milk yield of the Friesians was 941 kg/cow or 30% higher than that estimated for the Jerseys at the same stocking rate, and 1252 kg or 45% greater than at 4.21 Jerseys/ha. The higher milk yield of the Friesians more than compensated for the lower content of fat, protein, and to a lesser extent, lactose. The combined yield of these constituents from the Friesians was 72 kg/cow or 18%, and 119 kg/cow or 28% greater than that for Jerseys at 3.7 and 4.21 cows/ha respectively. The greatest difference was in lactose yield, the least in fat yield. A consequence was that for each 1.0 kg of fat, the Friesians produced 0.76 kg of protein and 1.04 kg of lactose, compared to 0.70 and 0.88 kg for the Jerseys. The Friesians were heavier than the Jerseys by up to 50 kg depending on the stocking rate.

On a per hectare basis (Table 3b), the production of milk, fat, protein and lactose from the Friesians was respectively 30, 6, 15 and 26% higher than that estimated for the Jerseys at the same stocking rate. Comparable advantages to the Friesians when the Jerseys were at 4.21 cows/ha were 27, 3, 13 and 23%.

Feed intake data (Table 3c) include both pasture and silage. Intake per cow was similar for the 2 breeds. As a consequence of this and the higher yield of milk solids by the Friesians, feed conversion efficiency was higher for the Friesians. Their advantage over the Jerseys was 10, 18 and 15% for yield of fat, milk solids, and SCM/kg DM respectively at 3.7 cows/ha. The advantage at 4.21 cows/ha was 10, 25 and 21%.

The amount of pasture on the farm at various times of the year (Table 3d) indicated a small advantage to the Jerseys. The amount of silage available, which represents the amount harvested less 20% for storage losses, indicates that at 4.21 cows/ha, additional feed would have to be bought in.

Estimated Performance of Jerseys when Feed Intake per Hectare Equalled that of Friesians

The stocking rate at which annual feed intake of the Jerseys was 15.78 t DM/ha, the same as that of the Friesians, was estimated to be 3.61 cows/ha. The performance of the Jerseys at this stocking rate was similar to that at 3.7 cows/ha and is therefore not presented.

Maximum Production per Hectare

A linear decrease in production per cow with increasing stocking rate was assumed in this analysis. This results in production per hectare being quadratic in nature, declining from a maximum beyond a certain stocking rate. The estimated maximum production per hectare of milk and its constituents for the Jerseys, and the stocking rates resulting in these, are in Table 4. These data imply that production per hectare of the Jerseys could not be increased to that of the Friesians by increasing their stocking rate.

TABLE 4 Estimated maximum production for Jerseys.

Variable	Stocking rate for maximum production (cows/ha)	Maximum production (kg/ha)
Fat	4.45	686 ± 19
Protein	4.32	476 ± 12
F + P + L	4.37	1 761 ± 47
SCM	4.40	15 200 ± 437

DISCUSSION

The data presented here indicate that the well established higher per cow production of the Friesians compared to the Jerseys may also be reflected in higher per hectare production. This finding cannot be regarded as conclusive. The data were from 2 separate although similar experiments.

TABLE 3 Performance of Friesians and Jerseys at 3.7 cows/ha and of Jerseys at 4.21 cows/ha when LW/ha was the same for both breeds.

Variable	Friesians	Jerseys	
Cows/ha	3.70	3.70	4.21
(a) Performance/cow			
Days in milk	260 ± 1	259 ± 4	248 ± 5
Milk (kg)	4058 ± 32	3117 ± 73	2806 ± 94
F (%)	4.72 ± 0.04	5.78 ± 0.07	5.78 ± 0.09
P (%)	3.58 ± 0.01	4.04 ± 0.04	4.02 ± 0.05
L (%)	4.94 ± 0.01	5.10 ± 0.01	5.09 ± 0.01
F (kg)	192 ± 2	180 ± 3	163 ± 3
P (kg)	145 ± 1	126 ± 2	113 ± 3
L (kg)	200 ± 2	159 ± 4	143 ± 5
F + P + L (kg)	537 ± 37	465 ± 8	418 ± 11
SCM (kg)	4506 ± 32	4003 ± 68	3603 ± 88
P/F	0.76 ± 0.004	0.70 ± 0.002	0.70 ± 0.003
Mean LW (kg)	402 ± 2	365 ± 5	353 ± 6
Calving LW (kg)	406 ± 4	380 ± 7	371 ± 9
Calving condition (scores)	5.1 ± 0.1	5.9 ± 0.2	5.5 ± 0.3
(b) Performance/hectare			
Milk (t)	15.01 ± 0.12	11.53 ± 0.27	11.81 ± 0.40
F (kg)	710 ± 6	667 ± 11	686 ± 16
P (kg)	537 ± 4	466 ± 8	476 ± 11
L (kg)	740 ± 6	588 ± 14	602 ± 20
F + P + L (kg)	1987 ± 14	1719 ± 31	1758 ± 46
SCM (t)	16.6 ± 0.1	14.8 ± 0.3	15.2 ± 0.4
Mean LW (kg)	1487 ± 8	1350 ± 18	1487 ± 27
(c) Intake and conversion efficiency			
DMI (kg/cow)	4263 ± 49	4333 ± 69	4146 ± 89
DMI (t/ha)	15.8 ± 0.2	16.0 ± 0.3	17.5 ± 0.4
F/DMI (g/kg)	45 ± 0.5	41 ± 0.8	39 ± 1.0
(F + P + L)/DMI (g/kg)	126 ± 1	107 ± 2	101 ± 3
SCM/DMI(g/kg)	1058 ± 11	922 ± 21	871 ± 27
(d) Farm performance			
Pasture on farm (t DM/ha)			
July	1.80 ± 0.07	2.03 ± 0.07	2.01 ± 0.09
December	2.70 ± 0.02	2.96 ± 0.10	2.76 ± 0.13
April	2.27 ± 0.03	2.71 ± 0.06	2.42 ± 0.08
Silage (kg DM/cow)	196 ± 4	365 ± 27	61 ± 35

Net pasture production on the Friesian farmlets was 14.0 and 16.3 (SE ± 0.35) t DM/ha in 1982-83 and 1983-84 respectively. For the Jersey farms it was 12.4 and 15.7 ± 0.21 t DM/ha. The difference between years was due mainly to the wetter summer of the second year. Even if the difference in pasture production between the 2 experiments was real, the evidence is that it would not account for the superior performance of the Friesians. Their production of milk solids (F + P + L) was 1950 and 2024 kg/ha in the first and second years respectively. That of the Jerseys, averaged over all stocking rates was 1618 and 1769 kg/ha. The marginal response between years for Jerseys was therefore 46 kg solids/ha for each extra 1.0 t DM/ha grown. The 1.6 t DM/ha extra pasture production on the Friesian farms in the first year would have accounted for only 74 of the 332 kg solids/ha difference between the 2 breeds in that year. Further, the differing levels of conservation would have acted to compensate for any difference in pasture production between the various farms. A consequence is that the Jerseys had more feed on their farms than did the Friesian at all times of the year (Table 3d).

The experimental Friesians were less representative of the breed than were the Jerseys. There were fewer Friesian sires represented, and 2 of these had 104 daughters present in the first year and

91 in the second. The Friesian herd included 35 and 19 cows of unrecorded ancestry in the first and second years respectively, and contained 20 to 25% of Jersey blood. These features may account for the small difference in LW between the 2 groups of animals. They may also account for the Friesian milk having a fat content of 4.7% compared to the 4.1% of tested pedigree Friesians (NZDB, 1983). Even so, trends within the breeds appear to be towards an increase in Friesian test and size of Jerseys (Macmillan *et al.*, 1984).

The higher production of the Friesians was not due to a higher food intake. It was due primarily to their superior food conversion efficiency. This occurred even though the Jerseys were not disadvantaged in terms of their condition at calving, the amount of feed on the farm throughout the year, or days in milk.

Observations made during the course of this work suggest that the Friesians were less selective in their grazing. Swards were more uniformly grazed during the 24 h than those grazed by the Jerseys. Satisfactory pasture control was therefore more easily maintained with the Friesians. The technique used for measuring daily intake provided data on a number of pasture parameters. Investigation of the grazing characteristics of the 2 breeds using these data was not considered valid because the grazing interval differed between the 2 trials.

The popularity of the Jersey breed in New Zealand has steadily declined. Even so about 35% of inseminations made in 1983 by the Livestock Improvement Associations were with Jersey semen. The decline in popularity is probably mainly because the demand and prices paid for Friesians for meat production are higher than those for Jerseys. It has not been because of unequivocal evidence that Friesians result in higher dairy production per hectare. The analysis presented here goes some way towards providing that evidence. The differences revealed between the 2 breeds are sufficiently large, and the proportion of the Jerseys in the national herd sufficiently great, to warrant greater emphasis on encouraging the present trend towards Friesian.

ACKNOWLEDGEMENTS

To the staff of the Ruakura No. 2 and 5 Dairies, and to Dr N.R. Cox for statistical analysis.

REFERENCES

Campbell A.G. 1977. Comparative dairy production of Jerseys and Friesian-Jersey crossbreds. *Proceedings of the New Zealand Society of Animal Production* **37:** 25-31.

Macmillan K.L.; Duganzich D.M.; Bryant A.M. 1981. Production differences between Jersey and Friesian x Jersey cows in commercial dairy herds. *Proceedings of the New Zealand Society of Animal Production* **41:** 48-52.

Macmillan K.L.; Henderson H.V.; Bryant A.M. 1984. Variations in milkfat test, live weight, colour and height associated with the use of Friesian sires in some New Zealand dairy herds. *Proceedings of the New Zealand Society of Animal Production* **44:** 71-73.

NZDB 1954. *30th Annual report and statement of accounts,* New Zealand Dairy Board, Wellington, p.26.

NZDB 1983. 59th Farm production report, New Zealand Dairy Board Farm Production Division, Hamilton, p.26.

Quartermain A.R.; Carter A.H. 1969. Weight and productivity of dairy cattle. *Proceedings of the Ruakura farmers' conference week:* 165-177.

Stichbury J.W. 1965. Production of Friesian-Jersey crossbreds. *Proceedings of the Ruakura farmers' conference week*: 241-245.