MILK PRODUCTION FROM IRRIGATED NITROGEN FERTILIZED PANGOLA GRASS

G.D. CHOPPING*, H.D. DEAN*, R. SIBBICK*, P.N. THURBON*, and MRS. J. STOKOE**

Summary

The project compared milk production and composition of Jersey and Friesian cows grazing irrigated pangola grass fertilized with 672 kg N/ha/annum. Friesians were stocked at 5.9 and 7.9 cows/ha, and Jerseys at 7.9 and 9.9 cows/ha. A supplement of 3.6 kg/head/day of molasses/urea/M.A.P. (97:2:1) was also evaluated.

High levels of production per unit area were achieved. Supplemented Friesians at the high stocking rate averaged 25626 kg milk and 863 kg fat/ha, Corresponding values for the comparable Jersey group were 21348 kg milk and 954 kg fat/ha, For both breeds increasing the stocking rate reduced per cow production and generally, though not always, increased per hectare production, Per hectare production of the highly stocked Friesian group exceeded that of the lower stocked group by an average of 6.7% for milk (21551 kg v 23003 kg), 2.8% for fat (763 kg v 784 kg) and 6.9% for S.N.F. (1771 kg v 1893 kg). For Jerseys, corresponding increases were 9.7% for milk (17927 kg v 19668 kg), 3.9% for fat (830 kg v 862 kg) and 8.0% for S.N.F. (1529 kg v 1651 kg).

Molasses supplement was very effective in raising milk production. On average Friesians gave 0.67 kg milk per kg of molasses fed. For Jerseys the figure was 0.39 kg milk per kg of molasses. Supplement feeding also generally increased lactation length and the S.N.F. % of milk,

The project has demonstrated that dairying can be successfully undertakenunder true tropical conditions.

I. INTRODUCTION

Swain (1971) claimed it was doubtful whether a viable dairying industry could be maintained in the tropics if it had to rely on legume grass pastures. Basically this was because of low output per cow and per hectare. A grazing system based on nitrogen fertilization should be capable of far higher output per hectare because it should support higher cow numbers per unit area. This project was undertaken to examine the effect on per hectare production of breed, stocking rate and supplementation at a high level of grass fertilization in a tropical environment. With the increasing use of nitrogen fertilizer on dairy pastures in Queensland this question has major relevance.

II, MATERIALS AND METHODS

A 2 x 2 x 2 factorial design was used to examine the effect on milk production of:- breed (Friesian v Jersey; 16 animals (four groups of four) of each breed were involved); stocking rate (5.9 v 7.9 cows/ha for Friesians, and 7.9 v 9.9 cows/ha for Jerseys); and supplement (nils 3.6 kg/head/day of a molasses:urea:M.A.P. mixture (97:2:1 - in year 3 urea replaced biure t isonitrogenously).

*Department of Primary Industries, Ayr Research Station, AYR, Queensland.
**Griffiths University, BRISBANE, Queensland.

(a) Pasture management

The pasture was irrigated *Digitaria decumbens*. A two paddock system per group of four cows was used, each paddock being grazed for three weeks and rested for three weeks. Nitrogen (672 kg/ha/annum as ammonium nitrate in years 1 and 2 and urea in year 3) was applied in equal applications every six weeks during the pasture rest phase. Phosphate (43 kg/ha) and potassium (62 kg/ha) were applied as a single dressing every August. An electric fence shifted daily was used to ration pasture from autumn to late spring.

(b) Animal management

Initially within each breed cows were randomly allocated to one of four stocking rate x supplement treatments approximately six weeks prior to the mean calving date. In subsequent years one cow in each group was replaced by a heifer when the cow to be replaced completed her lactation. For 14 days following calving each cow was yard fed on *Medicago sativa* hay and molasses to determine initial milk yield under a fixed nutritional system. This data was used for a covariance correction to minimise variation due to initial yield differences, Apart from this 14 day period the cows were maintained year round on the same pasture area. Daily milk yield, weekly fat and S.N.F. percentages and monthly live weights were recorded. Cows were dried off when the weekly milk yield declined to 23 kg. Rectal temperatures of the cows were taken weekly at an afternoon milking over the period December, 1970 to March, 1971.

III. RESULTS

Each years results were analysed separately by covariance analysis using milk production over lactation days 5 to 14 on a standard ration as a covariate to correct for inherent differences in production. Corrected treatment effects on per cow and per hectare milk, fat and total solids production are shown in Table 1. Actual milk composition data (not covariance corrected) is also given in Table 1,

TABLE 1

Effect of stocking rate and supplement level on per animal and per hectare production and milk composition of Jersey and Friesian cows grazing irrigated pangola grass over three lactations

	Friesians									Jerseys								
Treatment	Milk			Fat			Total Solids			Milk			Fat			Total Solids		
Year	70-71	71-72	72-73	70-71	71-72	72-73	70-71	71-72	72-73	70-71	71-72	72-73	70-71	71-72	72-73	70-71	71-72	72-73
Production/Animal (kg) (Covariance Corrected Date)																		
Stocking rate																		
Low	4518	3379	3010	165	117	104	527	399	356	2472	2231	2102	120	102	93	336	292	267
High	3029	2855	2840	109	91	98	364	323	329	2141	1822	2009	98	76	89	281	227	256
S.E.	442	370	677	24	19	25	64	48	83	328	192	279	16	13	14	45	28	36
L.S.D. 5%	1453	1155	2111	80	59	77	210	150	259	1049	610	868	51	40	44	143	90	111
L.S.D. 1%	2051	1630	2978	113	84	108	296	212	365	1481	861	1224	72	56	62	202	127	156
Sig.	L>H**	L>H*	n.s.	L>H**	n.s.	n.s.	L>H**	n.s.	n.s.	n.s.	L>H**	n.s.	n.s.	L>H**	n.s.	n.s.	L>H**	n.s.
Supplement																		
Plus	4242	3503	3403	148	113	116	495	404	400	2649	2453	2063	127	108	93	362	316	265
Nil	3305	2731	2447	127	95	86	396	319	286	1964	1600	2048	91	70	89	255	203	258
S.E.	418	379	761	23	19	28	60	49	93	323	198	279	16	13	14	44	29	36
L.S.D. 5%	1308	1210	2603	72	62	95	189	157	319	1025	650	867	50	42	44	140	96	110
L.S.D. 1%	1846	1707	3674	102	87	134	267	222	451	1446	917	1223	71	60	62	198	135	156
Sig.	P>N**	P>N*	n.s.	n.s.	n.s.	n.s.	P>N*	n.s.	n.s.	P>N**	P>N**	n.s.	P>N**	P>N**	n.s.	P>N**	P>N**	n.s.
Production/Hectare (kg) (Covariance Corrected Data)																		
Low plus	30384	22468	21667	1051	737	726	3476	2613	2554	22466	21670	17880	1102	982	805	3113	2825	2262
Low nil	23186	17597	14019	902	651	510	2773	2117	1668	16608	13593	15342	795	626	669	2202	1788	1966
High plus	26552	25417	24910	932	796	860	3188	2894	2911	24255	21380	18409	1133	899	829	3258	2705	2403
High nil	21337	19714	19988	799	640	682	2564	2218	2294	18054	14622	21286	795	594	923	2287	1777	2649
Percentage Composition (Uncorrected Data)																		
Low plus				3.60	3.28	3.31	11.73	11.63	11.75				4.85	4.56	4.34	13.73	13.09	12.62
Low nil				3.93	3.74	3.76	12.03	12.10	12.00				4.80	4.60	4.55	13.28	13.15	13.05
High plus				3.41	3.10	3.39	11.72	11.31	11.64				4.69	4.24	4.66	13.48	12.71	13.19
High nil				3.61	3.28	3.47	11.73	11.31	11.51				4.43	3.82	4.08	12.73	11.68	12.24

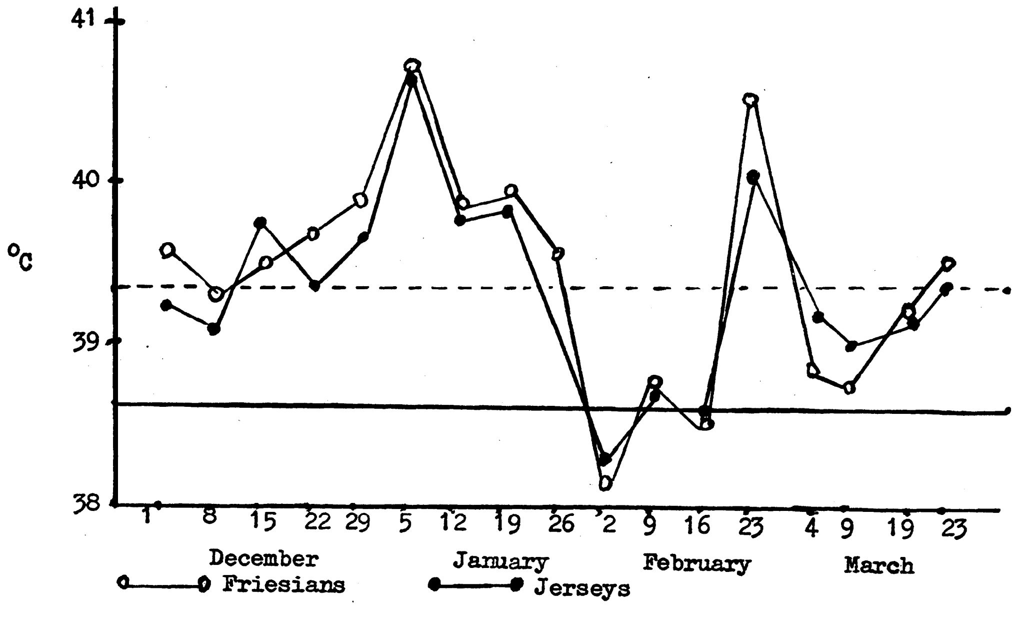
Stocking rate - Friesians - Low = 5.93 cows/ha; High = 7.90 cows/ha. *Significantly different at 5% level.
Jerseys - Low = 7.90 cows/ha; High = 9.88 cows/ha. **Significantly different at 1% level.

Milk production in the first lactation averaged 16.9% above the second lactation and 19.1% above the third lactation. Friesians and Jerseys averaged 3272 kg milk and 114 kg fat, and 2130 kg milk and 96 kg fat per lactation respectively. For both breeds increasing the stocking rate reduced per cow production and generally increased per hectare production. For Friesians, increasing the stocking rate (5.9 to 7.9 cows /ha) reduced average per hectare production in the first lactation but increased production in lactations two and three. The average increase in per hectare production due to increased stocking rate was 6.7% for milk (21551 kg v 23003 kg), 2.8% for fat (763 kg v 784 kg) and 6.9% for S.N.F. (1771 kg v 1893 kg). For Jerseys corresponding increases were 9.7% for milk (17927 kg v 19668 kg), 3.9% for fat (830 kg v 862 kg) and 8.0% for S.N.F. (1529 kg v 1651 kg).

Molasses raised milk yield by an average of 0.67 kg milk/kg molasses with Friesians and 0.39 kg milk/kg molasses with Jerseys. In addition, supplement feeding generally increased lactation length and the S.N.F. % of milk. Milk casein percentages were low especially over summer when Friesian milk averaged 2.18% and Jersey milk 2.66%.

Weekly variations in mean rectal temperature for each breed are show-n in Fig. 1 for the period December, 1970 to March, 1971. The mean temperature for both groups over much of this period was outside what is regarded as a normal range (Hungerford 1967). Friesians-showed more obvious signs of heat stress than did Jerseys.

Fig. 1. Variations in rectal temperature (°C) of Friesians and Jerseys at one afternoon milking weekly over period December 1970 to March 1971



IV. DISCUSSION

Payne (1963) suggested it should be possible on "good humid tropical pastures" to maintain five dairy cows/ha each producing at least 2720 kg of milk annually; This target of 13600 kg milk/ha has beengreatly surpassed in this experiment. . Furthermore, consistent results in the second and third lactations would indicate that the system used was reasonably stable. The higher production levels recorded in the first lactations were caused by two factors. Firstly only mature animals were used in the first lactation while in the second and third lactations one heifer/group was used. Secondly, animals commenced the first lactation in better condition than they commenced subsequent lactations. Ephemeral fever was a problem in the third year, especially with Jerseys. This had the effect of nullifying the effect of supplement with this group in that year and is the major cause of the difference between breeds in milk response to supplement.

Rectal temperature data during summer indicated that heat stress was at a level where substantial effects on milk production and composition . could be expected (Bianca 1965). Milk protein is a sensitive indicator of heat stress (Donnegan pers. comm.) and low summer casein percentages recorded for both Jersey and Friesian are consistent with this and go a way to explaining the problem of low S.N.F. content of milk, However, low S.N.F. percentages were recorded year round and it is probable that the low energy concentration of tropical species combined with relatively low intakes of pasture dry matter (c.f. temperate species) are largely responsible. Heat stress in summer would aggrevate the problem further by reducing intake, The above would indicate good responses could be expected both in milk production and S.N.F. % to energy supplementation even in those periods of the year when feed is available in excess (e.g. summer). Results from this trial are consistent with this,

It would seem that the tropics by exploiting the high levels of dry matter that can be produced under their climatic conditions and utilizing a cheap energy source such as molasses can rival temperate regions in milk production per unit of land even though individual cow yields are not high.

V. REFERENCES

BIANCA, W. (1965). Journal of dairy Research 32:291.

HUNGERFORD, T.G. (1967). "Diseases of Livestock" 6th ed. (Angus and Robertson: Sydney).

PAYNE, W.J.A. (1963). Proceedings of world Congress of animal Production Rome 3:205.

SWAIN, F.C. (1971). Tropical Grasslands 5.3:269