Report of the Grasslands Trials Unit 1975 - 79

FALKLAND ISLANDS

APPENDIX 3

APPENDIX 3.1 WOOL GROWTH

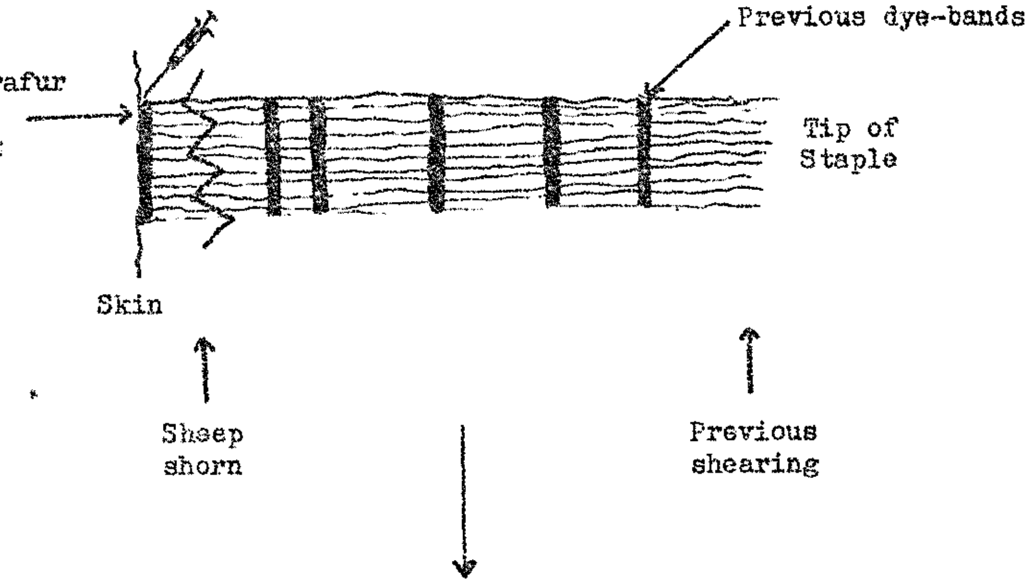
REF: W.G. 3.1 78/79

SUMMARY:

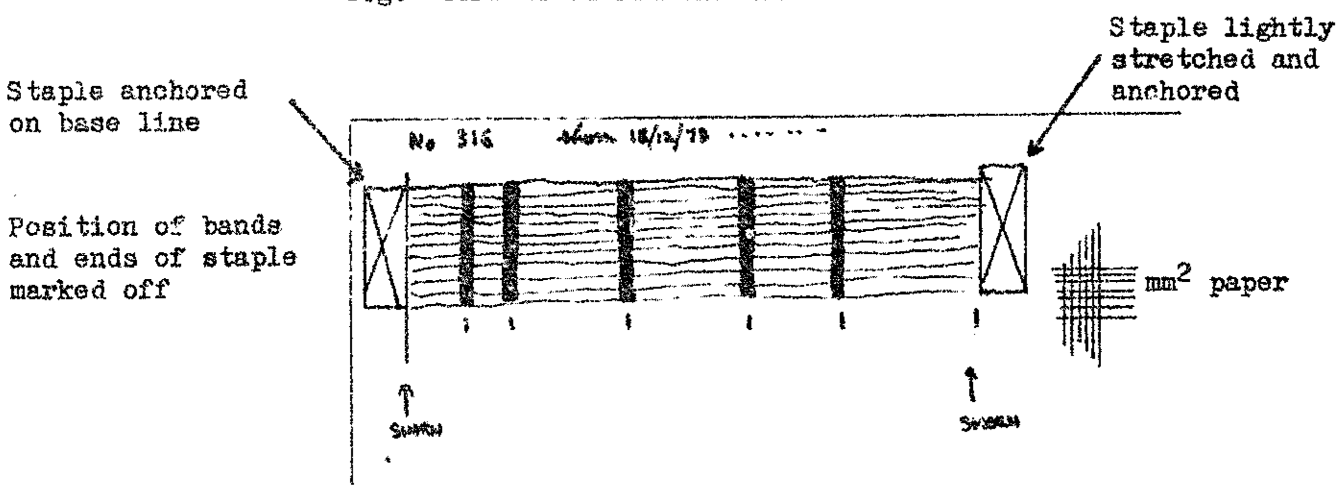
Observational studies on the pattern of wool growth in a range of ages and classes of sheep have been carried out using a modified dye-banding technique. Entire staples were measured and the Mean % Staple Growth in periods of known length calculated (TABLES 1A - 7). Mean % Daily Staple Growth was also calculated and plotted in the form of histograms (FIGS 1 - 26), for lactating ewes and dry sheep from the Two Pasture System Trial (1.1) and the Dry Sheep Investigation (1.3).

DYEBANDING & STAPLE MEASUREMENT TECHNIQUE

TYPICAL STAPLE ON FLANK OF SHEEP



e.g. TYPICAL STAPLE UNDERGOING MEASUREMENT



Lengths and intervals for a number of staples are then tabulated e.g:

Date:	18/12/78 ↔ 12/1/79......................						
Period:	6	5	4	3	2	1	TOTAL
No. 316	7.3	6.0	15.8	16.2	12.7	18.5	76.5mm
Conversion to % growth per period e.g:	9.5	7.8	20.6	21.2	16.6	24.3	100%

These % growth per period figures were averaged vertically for a number of sheep with the same history (e.g. same age; all weaned a lamb etc.) to give MEAN % STAPLE GROWTH PER PERIOD as in the following tables, together with the SAMPLE SIZE and STANDARD ERROR of the MEAN.

The % DAILY STAPLE GROWTH (PER PERIOD) was derived by dividing the MEAN % STAPLE GROWTH PER PERIOD by the number of days in the period (i.e. between bands).

APPENDIX 3.1 WOOL GROWTH

REF: W.G. 3.1/1.1 78/79

TABLE 1A: 78/79 SEASONAL WOOL GROWTH PATTERN - LACTATING EWES FROM FYRGS (R) (1.1) CONTROL FLOCK

	PERIOD:		1	2	3	4	5	
		9/1/78	← → 1/3/78	← → 31/5/78	← → 15/8/78	← → 12/1/79	← → 26/2/79	
			DB	DB	DB	DB		
	DAYS:	SHORN	51 (LACTATION)	SHORN 91 MATING	76 (WINTER)	150 (LAMBING)	45 (LACTATION)	SHORN
'71 AGE ('A') EWES (4 CROP) 1 SHORN JAN	MEAN % STAPLE GROWTH:		35.7	17.8	17.8	19.7	9.0	
	SAMPLE SIZE:		5	5	5	5	5	
	STANDARD ERROR:		±2.08	±1.52	±1.68	±2.32	±0.81	
	% DAILY STAPLE GROWTH:		0.700	0.196	0.234	0.131	0.200	
'71 AGE ('A') EWES (4 CROP) 2 SHORN MAR	MEAN % STAPLE GROWTH:		-	31.9	21.6	29.4	16.5	
	SAMPLE SIZE:		-	6	6	6	6	
	STANDARD ERROR:		-	±2.33	±1.08	±3.99	±3.02	
	% DAILY STAPLE GROWTH:		-	0.350	0.284	0.196	0.367	
'72 AGE ('B') EWES (3 CROP) 1 SHORN JAN	MEAN % STAPLE GROWTH:		28.3	16.7	17.7	28.8	8.5	
	SAMPLE SIZE:		3	3	3	3	3	
	STANDARD ERROR:		±3.53	±1.64	±2.89	±4.78	±0.75	
	% DAILY STAPLE GROWTH:		0.555	0.183	0.233	0.192	0.189	
'72 AGE ('B') EWES (3 CROP) 2 SHORN MAR	MEAN % STAPLE GROWTH:		-	30.5	22.2	31.9	15.3	
	SAMPLE SIZE:		-	10	10	10	10	
	STANDARD ERROR:		-	±3.76	±1.50	±2.21	±2.42	
	% DAILY STAPLE GROWTH:		-	0.335	0.292	0.213	0.340	

1 SAMPLE SHEEP SHORN 9/1/78
2 SAMPLE SHEEP SHORN 1/3/78

ALL EWES WEANED A LAMB

DB - STAPLES DYE-BANDED ON THESE DATES

ALL DATA FROM FYRGS (R) (1.1) 78/79

T.P.M. 9/79

APPENDIX 3.1 WOOL GROWTH

REF: W.G. 3.1/1.1 78/79

TABLE 1B: 78/79 SEASONAL WOOL GROWTH PATTERN - LACTATING EWES FROM FYRGS (R) (1.1) CONTROL FLOCK

		1	2	3	4	5
	PERIOD:	9/1/78 ↔ 1/3/78	1/3/78 ↔ 31/5/78	31/5/78 ↔ 15/8/78	15/8/78 ↔ 12/1/79	12/1/79 ↔ 26/2/79
		SHORN (9/1/78) → DB SHORN (1/3/78)	DB SHORN (1/3/78) → DB MATING (31/5/78)	DB MATING (31/5/78) → DB (15/8/78)	DB (15/8/78) → DB (12/1/79)	DB (12/1/79) → SHORN (26/2/79)
	DAYS:	51 (LACTATION)	91	76 (WINTER)	150 (LAMBING)	45 (LACTATION)
'73 AGE ('C') EWES (2 CROP) 1 SHORN JAN	MEAN % STAPLE GROWTH:	23.7	22.3	17.5	26.0	10.5
	SAMPLE SIZE:	12	12	12	12	12
	STANDARD ERROR:	±2.88	±2.01	±0.99	±1.88	±1.29
	% DAILY STAPLE GROWTH:	0.465	0.245	0.230	0.173	0.233
'73 AGE ('C') EWES (2 CROP) 2 SHORN MAR	MEAN % STAPLE GROWTH:	-	35.7	22.5	29.4	12.3
	SAMPLE SIZE:	-	7	7	7	7
	STANDARD ERROR:	-	±1.45	±0.86	±1.63	±1.53
	% DAILY STAPLE GROWTH:	-	0.392	0.296	0.196	0.273
'74 AGE ('D') EWES (1 CROP) 1 SHORN JAN	MEAN % STAPLE GROWTH:	17.7	25.4	18.1	27.2	11.5
	SAMPLE SIZE:	11	11	11	11	11
	STANDARD ERROR:	±2.77	±2.35	±0.98	±1.28	±1.72
	% DAILY STAPLE GROWTH:	0.347	0.279	0.238	0.181	0.256
'74 AGE ('D') EWES (1 CROP) 2 SHORN MAR	MEAN % STAPLE GROWTH:	-	35.5	20.4	32.5	11.4
	SAMPLE SIZE:	-	11	11	11	11
	STANDARD ERROR:	-	±2.66	±1.80	±2.18	±1.25
	% DAILY STAPLE GROWTH:	-	0.390	0.268	0.217	0.253

1 SHEEP SHORN 9/1/78
2 SHEEP SHORN 1/3/78

ALL EWES WEANED A LAMB

DB - STAPLES DYE-BANDED ON THESE DATES

ALL DATA FROM FYRGS (R) (1.1) 78/79

T.P.M. 9/79

APPENDIX 3.1 WOOL GROWTH

REF: W.G. 3.1/1.1 78/79

TABLE 2: 78/79 SEASONAL WOOL GROWTH PATTERN - LACTATING EWES FROM FYRGS (R) (1.1) TREATMENT FLOCK

			1	2	3	4	5	
	PERIOD:	9/1/78	9/1/78 → 1/3/78	1/3/78 → 31/5/78	31/5/78 → 15/8/78	15/8/78 → 12/1/79	12/1/79 → 26/2/79	26/2/79
				DB	DB	DB	DB	
	DAYS:	SHORN	51 (LACTATION)	91	76 (WINTER)	150 (LAMBING)	45 (LACTATION)	SHORN
				MATING				
'71 AGE ('1') EWES (4 CROP)	MEAN % STAPLE GROWTH:		30.6	11.9	14.6	35.3	7.5	
	SAMPLE SIZE:		4	4	4	4	4	
	STANDARD ERROR:		±4.24	±2.37	±3.12	±1.37	±0.75	
	% DAILY STAPLE GROWTH:		0.600	0.131	0.192	0.235	0.167	
'72 AGE ('2') EWES (3 CROP)	MEAN % STAPLE GROWTH:		28.9	13.4	17.6	33.7	6.3	
	SAMPLE SIZE:		5	5	5	5	5	
	STANDARD ERROR:		±3.74	±2.21	±2.38	±4.90	±0.92	
	% DAILY STAPLE GROWTH:		0.567	0.147	0.232	0.225	0.140	
'74 AGE ('4') EWES (1 CROP)	MEAN % STAPLE GROWTH:		27.3	10.2	17.3	36.3	6.9	
	SAMPLE SIZE:		3	3	3	3	3	
	STANDARD ERROR:		±4.54	±1.73	±2.19	±3.38	±1.54	
	% DAILY STAPLE GROWTH:		0.535	0.112	0.228	0.242	0.153	

ALL SAMPLE SHEEP SHORN 9/1/78
NO INFORMATION AVAILABLE FOR 1/3/78 SHEARING
NO INFORMATION AVAILABLE FOR '73 AGE (2 CROP) EWES

ALL EWES WEANED A LAMB
DB - STAPLES DYE-BANDED ON THESE DATES
ALL DATA FROM FYRGS (R) (1.1) 78/79

T.P.M. 9/79

APPENDIX 3.1 WOOL GROWTH

REF: W.G. 3.1/1.1 78/79

TABLE 3: 78/79 SEASONAL WOOL GROWTH PATTERN - LACTATING MAIDEN EWES FROM FYRGS (R) (1.1) CONTROL & TREATMENT FLOCKS

	PERIOD:	1	2	3	4	5
		DEC '77 SHORN	→ 31/5/78 DB MATING	→ 15/8/78 DB	→ 12/1/79 DB	→ 26/2/79 SHORN
	DAYS:		*	76 (WINTER)	150 (LAMBING)	45 (LACTATION)
'75 AGE ('E') MAIDEN EWES (O CROP) CONTROL	MEAN % STAPLE GROWTH:		43.5	18.3	30.7	7.5
	SAMPLE SIZE:		15	15	15	15
	STANDARD ERROR:		±1.77	±0.84	±1.70	±0.65
	% DAILY STAPLE GROWTH:		*	0.241	0.205	0.167
'75 AGE ('5') MAIDEN EWES (O CROP) TREATMENT	MEAN % STAPLE GROWTH:		42.0	18.4	33.4	6.2
	SAMPLE SIZE:		14	14	14	14
	STANDARD ERROR:		±0.71	±0.28	±0.91	±0.55
	% DAILY STAPLE GROWTH:		*	0.242	0.223	0.138

* SHEEP SHORN IN DECEMBER '77 BUT EXACT LENGTH OF PERIOD UNKNOWN

ALL EWES WEANED A LAMB
DB - STAPLES DYE-BANDED ON THESE DATES
ALL DATA FROM FYRGS (R) (1.1) 78/79

T.P.M. 9/79

APPENDIX 3.1 WOOL GROWTH

REF: W.G. 3.1/1.3 78/79

TABLE 4 : 78/79 SEASONAL WOOL GROWTH PATTERN - EWE & WETHER HOGGS

PERIOD: 1 2 3 4 5 6 7

20/10/77* ←→ 31/3/78 ←→ 13/5/78 ←→ 26/7/78 ←→ 13/10/78 ←→ 18/12/78

		BIRTH	31/3/78 DB	13/5/78 DB	26/7/78 DB	13/10/78 DB	18/12/78 SHORN
	DAYS:	162	43	74	79 (WINTER)	66	
'77 AGE EWE HOGGS	MEAN % STAPLE GROWTH:	47.2	9.3	14.7	14.7	13.9	
	SAMPLE SIZE:	22	22	22	22	22	
	STANDARD ERROR:	±0.64	±0.16	±0.39	±0.41	±0.36	
	% DAILY STAPLE GROWTH:	0.291	0.216	0.199	0.186	0.211	
'77 AGE WETHER HOGGS	MEAN % STAPLE GROWTH:	46.4	10.7	15.8	14.8	13.0	
	SAMPLE SIZE:	28	23	28	28	28	
	STANDARD ERROR:	±0.94	±C.34	±0.46	±0.41	±0.80	
	% DAILY STAPLE GROWTH:	0.286	0.249	0.213	0.187	0.197	

* ASSUMED MEAN BIRTH DATE

DB - STAPLES DYE-BANDED ON THESE DATES

ALL DATA FROM FYRGS (DS) (NA) (1.3) 78/79

APPENDIX 3.1 WOOL GROWTH

REF: W.G. 3.1/1.3 78/79

TABLE 5 : 78/79 SEASONAL WOOL GROWTH PATTERN - SHEARLING EWES & WETHERS

		1	1x	2	3	4	5	6
	PERIOD:	13/12/77 ↔ 16/1/78	16/1/78 ↔ 15/2/78	15/2/78 ↔ 31/3/78	31/3/78 ↔ 13/5/78	13/5/78 ↔ 26/7/78	26/7/78 ↔ 13/10/78	13/10/78 ↔ 18/12/78
	DAYS:	34 (SHORN 13/12/77; DB 16/1/78)	30 (DB 15/2/78)	44 (DB 31/3/78)	43 (DB 13/5/78)	74 (DB 26/7/78)	79 (WINTER) (DB 13/10/78)	66 (SHORN 18/12/78)
'76 AGE SHEARLING EWES (1 SHEAR)	MEAN % STAPLE GROWTH:	8.9	18.4	14.1	13.5	15.8	16.9	12.2
	SAMPLE SIZE:	27	27	27	27	27	27	27
	STANDARD ERROR:	±1.03	±1.26	±0.50	±0.31	±0.60	±0.67	±1.06
	% DAILY STAPLE GROWTH:	0.262	0.613	0.320	0.314	0.213	0.214	0.185
'76 AGE SHEARLING WETHERS (1 SHEAR)	MEAN % STAPLE GROWTH:	13.0	12.0	13.9	12.7	16.2	15.7	15.3
	SAMPLE SIZE:	26	26	26	26	26	26	26
	STANDARD ERROR:	±1.17	±0.80	±0.58	±0.39	±0.72	±0.64	±1.09
	% DAILY STAPLE GROWTH:	0.382	0.400	0.316	0.295	0.219	0.199	0.232

DB - STAPLES DYE-BANDED ON THESE DATES

ALL DATA FROM FYRGS (DS) (NA) (1.3) 78/79

T.P.M. 9/79

APPENDIX 3.1 WOOL GROWTH

REF: W.G. 3.1/1.3 78/79

TABLE 6 : 78/79 SEASONAL WOOL GROWTH PATTERN - ADULT DRY EWES

		Period 1	Period 2	Period 3	Period 4	Period 5	Period 6	Period 7
PERIOD:		13/12/77 (SHORN) → 16/2/78 (DB, SHORN)	16/2/78 → 31/3/78 (DB)	31/3/78 → 13/5/78 (DB)	13/5/78 → 26/7/78 (DB)	26/7/78 → 13/10/78 (DB)	13/10/78 → 18/12/78 (DB)	18/12/78 → 12/2/79 (SHORN)
DAYS:		65	43	43	74	79 (WINTER)	66	56
'71 AGE DRY EWES (6 SHEAR)	MEAN % STAPLE GROWTH:	-	18.9	13.3	19.8	17.3	20.1	10.5
	SAMPLE SIZE:	-	5	5	5	5	5	5
	STANDARD ERROR:	-	±0.75	±0.79	±0.82	±0.81	±0.58	±1.31
	% DAILY STAPLE GROWTH:	-	0.439	0.309	0.268	0.219	0.304	0.187
'72 AGE DRY EWES (5 SHEAR)	MEAN % STAPLE GROWTH:	-	18.2	13.1	19.0	16.5	20.7	12.4
	SAMPLE SIZE:	-	6	6	6	6	6	6
	STANDARD ERROR:	-	±0.91	±0.60	±0.74	±0.50	±0.66	±0.47
	% DAILY STAPLE GROWTH:	-	0.423	0.305	0.257	0.209	0.314	0.221
'73 AGE DRY EWES (4 SHEAR)	MEAN % STAPLE GROWTH:	-	18.1	12.7	18.5	18.1	19.4	13.1
	SAMPLE SIZE:	-	7	7	7	7	7	7
	STANDARD ERROR:	-	±0.43	±0.45	±0.41	±0.62	±0.37	±0.21
	% DAILY STAPLE GROWTH:	-	0.421	0.295	0.250	0.229	0.294	0.234
'74 AGE DRY EWES (3 SHEAR)	MEAN % STAPLE GROWTH:	-	16.7	12.9	18.3	18.8	19.8	13.3
	SAMPLE SIZE:	-	9	9	9	9	9	9
	STANDARD ERROR:	-	±1.10	±0.39	±0.46	±0.54	±1.06	±0.60
	% DAILY STAPLE GROWTH:	-	0.388	0.300	0.247	0.238	0.300	0.237
'75 AGE DRY EWES (2 SHEAR)	MEAN % STAPLE GROWTH:	22.6*	12.3	10.0	14.7	14.6	16.2	9.3
	SAMPLE SIZE:	3	3	3	3	3	3	3
	STANDARD ERROR:	±2.55	±0.40	±0.45	±1.30	±0.81	±0.41	±1.44
	% DAILY STAPLE GROWTH:	0.348	0.286	0.233	0.199	0.185	0.245	0.166

* 2 SHEAR EWES SHORN DECEMBER PRIOR TO ENTERING ADULT FLOCK

DB-STAPLES DYE-BANDED ON THESE DATES

ALL DATA FROM FYRGS (DS) (NA) (1.3) 78/79

REF: W.G. 3.1/1.3 78/79

TABLE 7 : 78/79 SEASONAL WOOL GROWTH PATTERN - ADULT WETHERS

PERIOD:		1	2	3	4	5	6
		13/12/77 ↔ 16/2/78 (DB)	16/2/78 ↔ 31/3/78 (DB)	31/3/78 ↔ 13/5/78 (DB)	13/5/78 ↔ 26/7/78 (DB)	26/7/78 ↔ 13/10/78 (DB)	13/10/78 ↔ 18/12/78
DAYS:		65	43	43	74	79 (WINTER)	66
		SHORN					SHORN
'72 AGE WETHERS (5 SHEAR)	MEAN % STAPLE GROWTH:	23.8	17.7	13.5	17.3	16.8	10.7
	SAMPLE SIZE:	3	3	3	3	3	3
	STANDARD ERROR:	±0.76	±1.73	±1.24	±1.25	±1.44	±1.14
	% DAILY STAPLE GROWTH:	0.366	0.412	0.314	0.234	0.213	0.162
'73 AGE WETHERS (4 SHEAR)	MEAN % STAPLE GROWTH:	19.9	14.3	19.6	19.6	16.3	14.2
	SAMPLE SIZE:	6	6	6	6	6	6
	STANDARD ERROR:	±3.41	±1.24	±2.70	±1.77	±2.17	±3.17
	% DAILY STAPLE GROWTH:	0.306	0.333	0.456	0.265	0.206	0.215
'74 AGE WETHERS (3 SHEAR)	MEAN % STAPLE GROWTH:	21.3	16.4	14.8	18.3	16.1	13.0
	SAMPLE SIZE:	10	10	10	10	10	10
	STANDARD ERROR:	±2.75	±1.29	±1.61	±0.58	±1.35	±1.92
	% DAILY STAPLE GROWTH:	0.328	0.381	0.344	0.247	0.204	0.199
'75 AGE WETHERS (2 SHEAR)	MEAN % STAPLE GROWTH:	22.8	16.7	14.9	17.2	17.1	11.3
	SAMPLE SIZE:	8	8	8	8	8	8
	STANDARD ERROR:	±2.05	±1.27	±1.05	±1.46	±1.88	±0.82
	% DAILY STAPLE GROWTH:	0.351	0.388	0.346	0.232	0.216	0.171

DB - STAPLES DYE-BANDED ON THESE DATES

ALL DATA FROM FYRGS (DS) (NA) (1.3) 78/79

T.P.M. 9/79

78/79 SEASONAL WOOL GROWTH PATTERN - LACTATING EWES FROM FYRGS (R) (1.1) CONTROL FLOCK

Refer to Table 1A

FIG 1: '71 AGE EWES (4 CROP) SHORN JANUARY

Sample Size: 5
All Weaned a Lamb

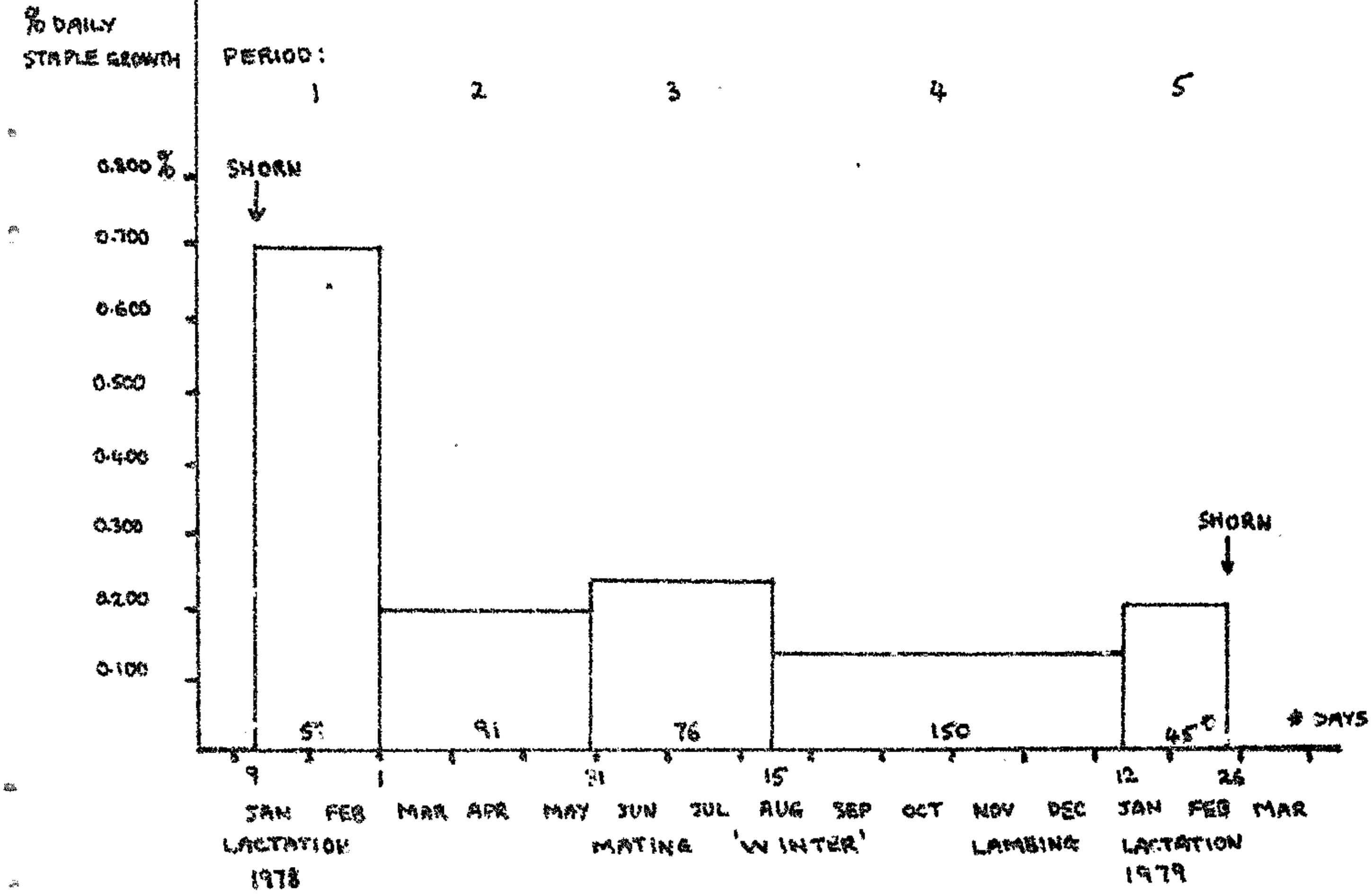
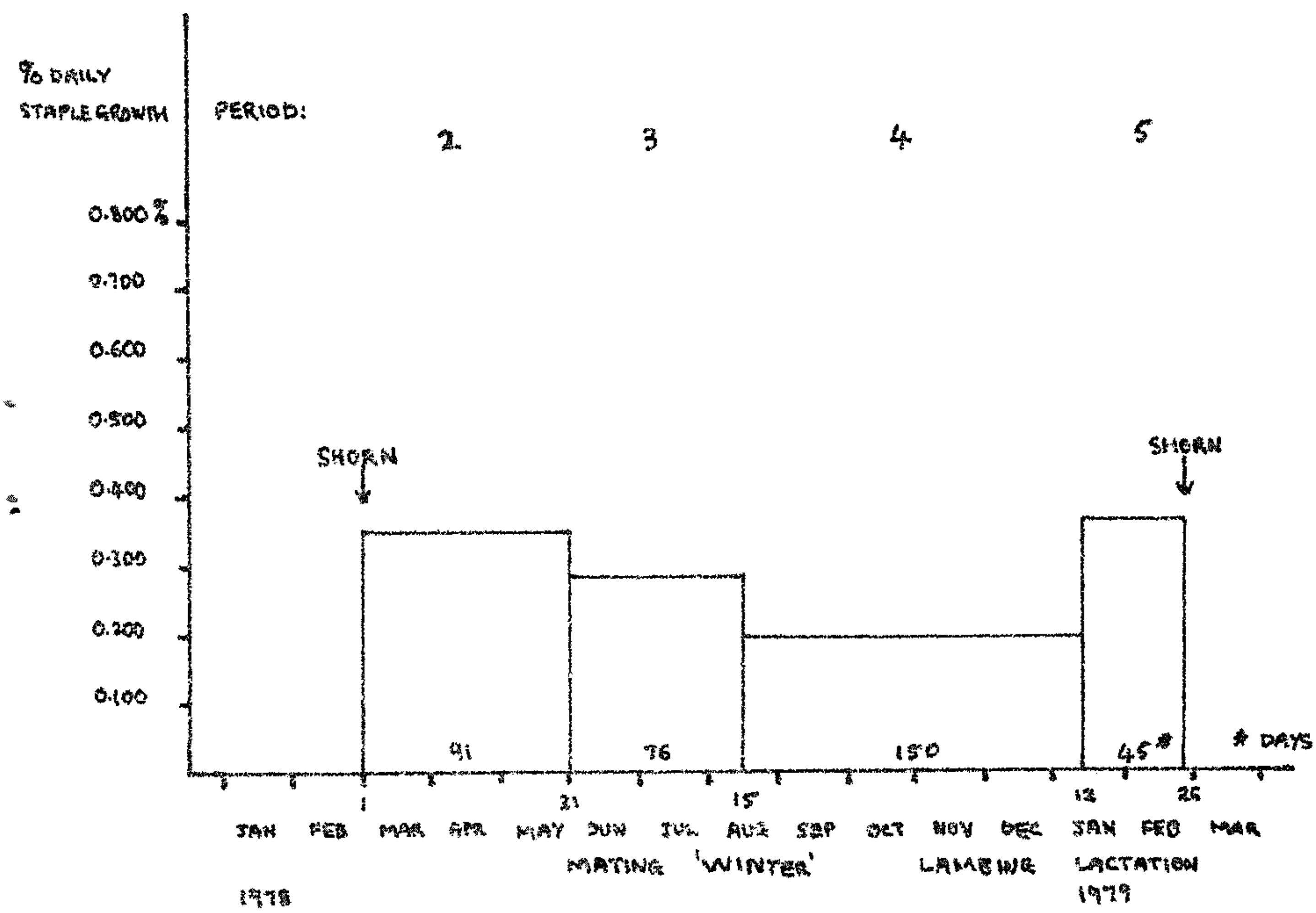


FIG 2: '71 AGE EWES (4 CROP) SHORN MARCH

Sample Size: 6
All Weaned a Lamb



DATA FROM FYRGS R (1.1) 78/79

78/79 SEASONAL WOOL GROWTH PATTERN - LACTATING EWES FROM FYRGS (R) (1.1) CONTROL FLOCK

Refer to Table 1A

FIG 3: '72 AGE EWES (3 CROP) SHORN JANUARY

Sample Size: 3
All Weaned a Lamb

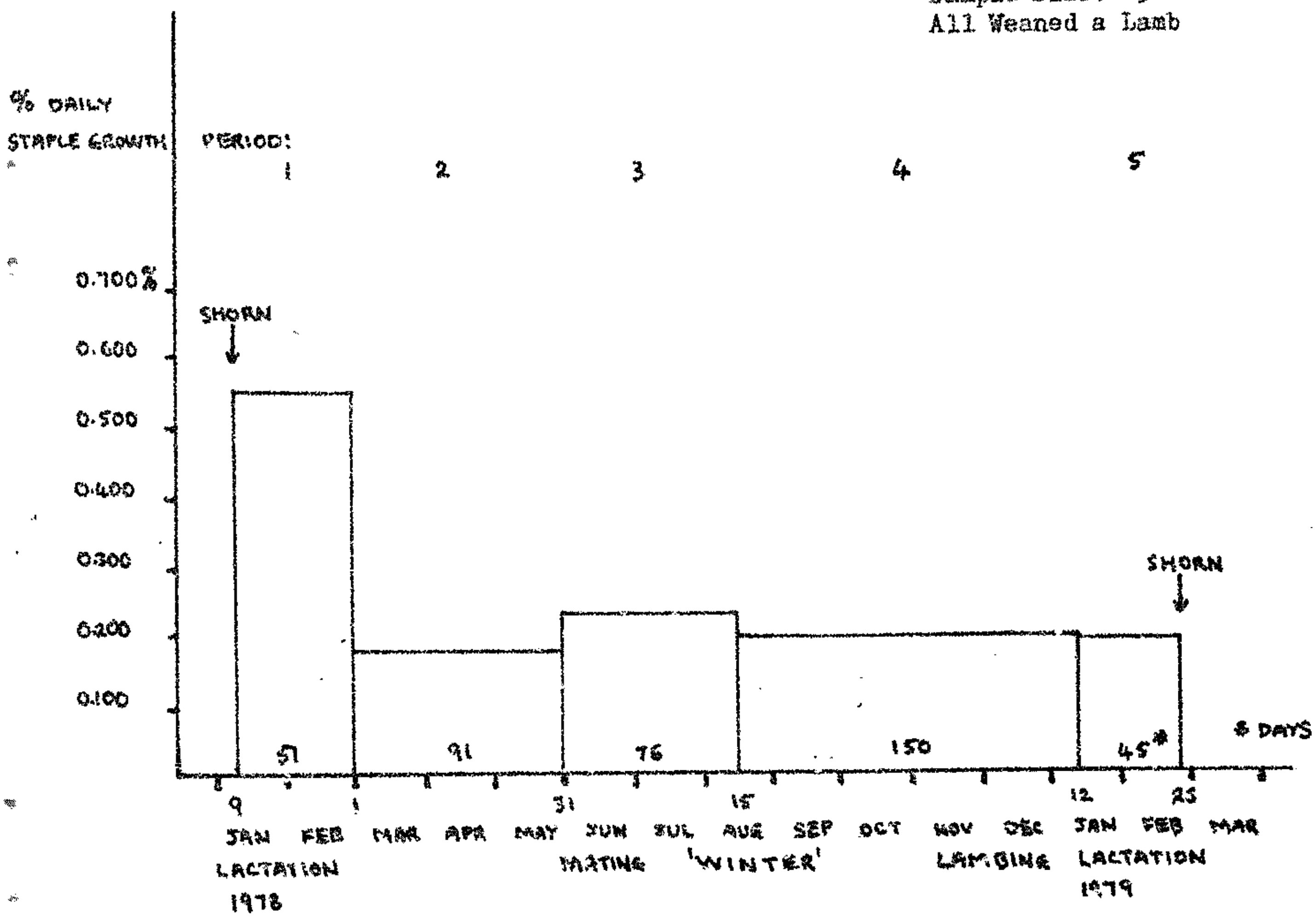
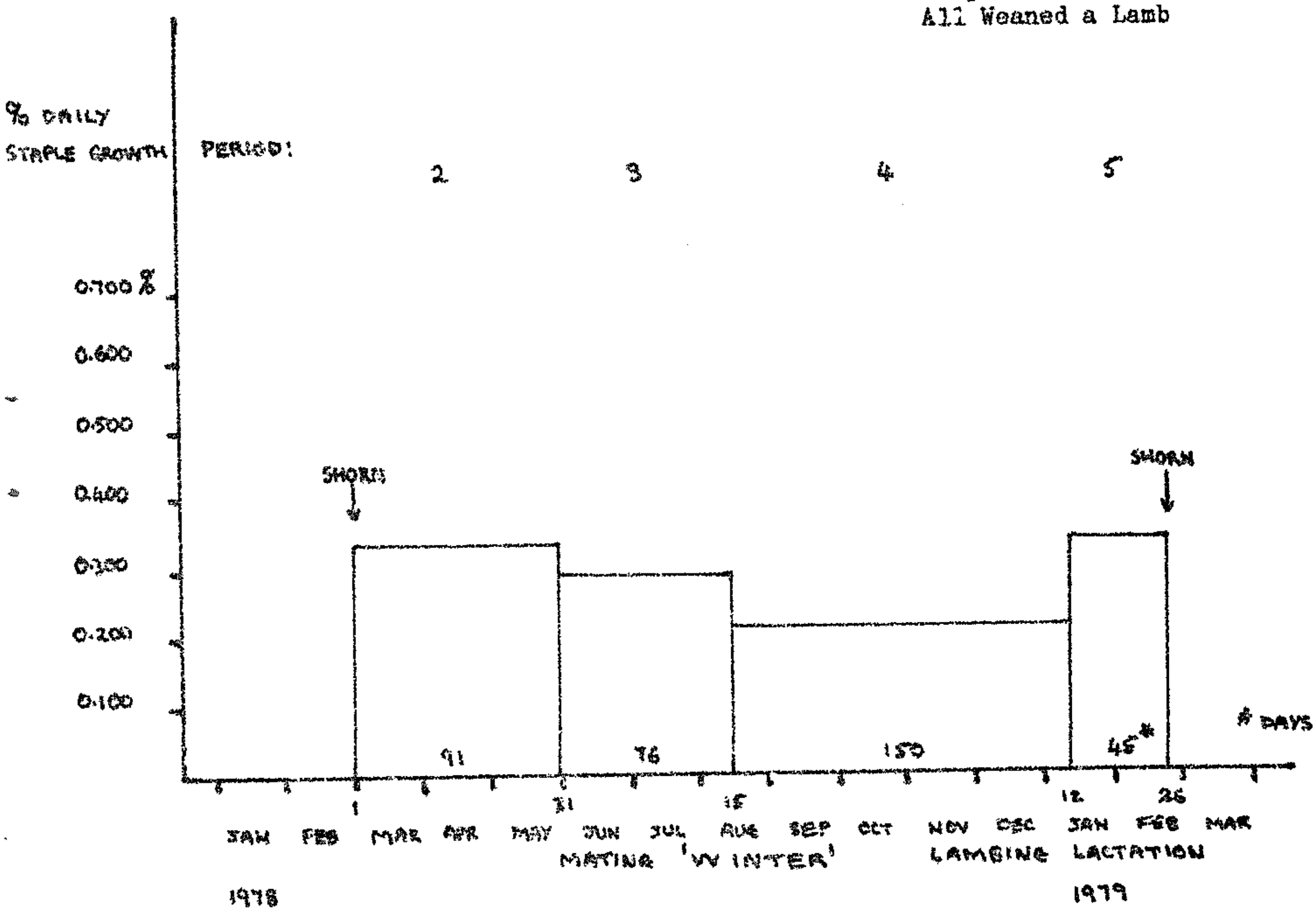


FIG 4: '72 AGE EWES (3 CROP) SHORN MARCH

Sample Size: 10
All Weaned a Lamb



78/79 SEASONAL WOOL GROWTH PATTERN - LACTATING EWES FROM FYRGS (R) (1.1) CONTROL FLOCK

Refer to Table 1B

FIG 5: '73 AGE EWES (2 CROP) SHORN JANUARY

Sample Size: 12
All Weaned a Lamb

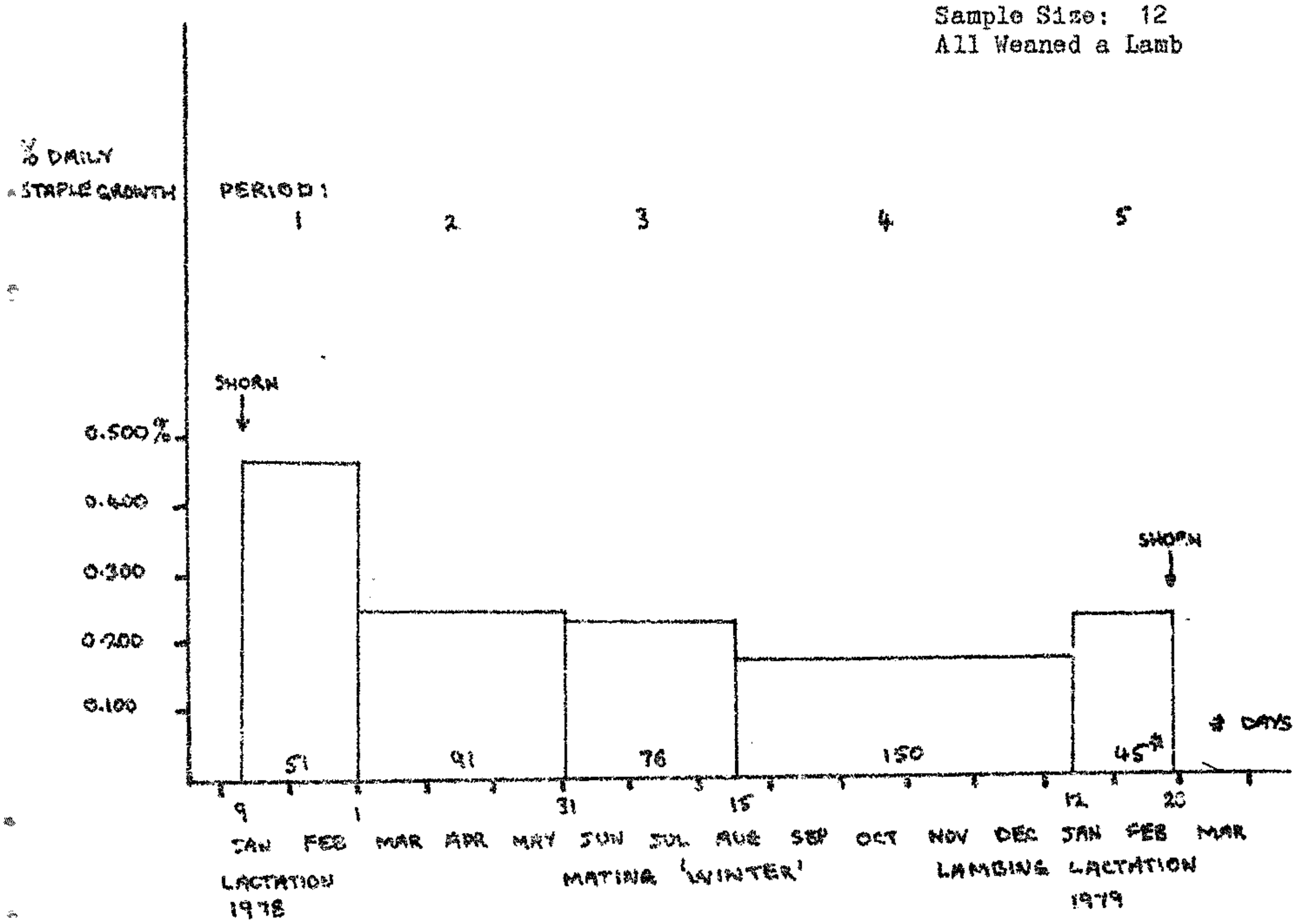
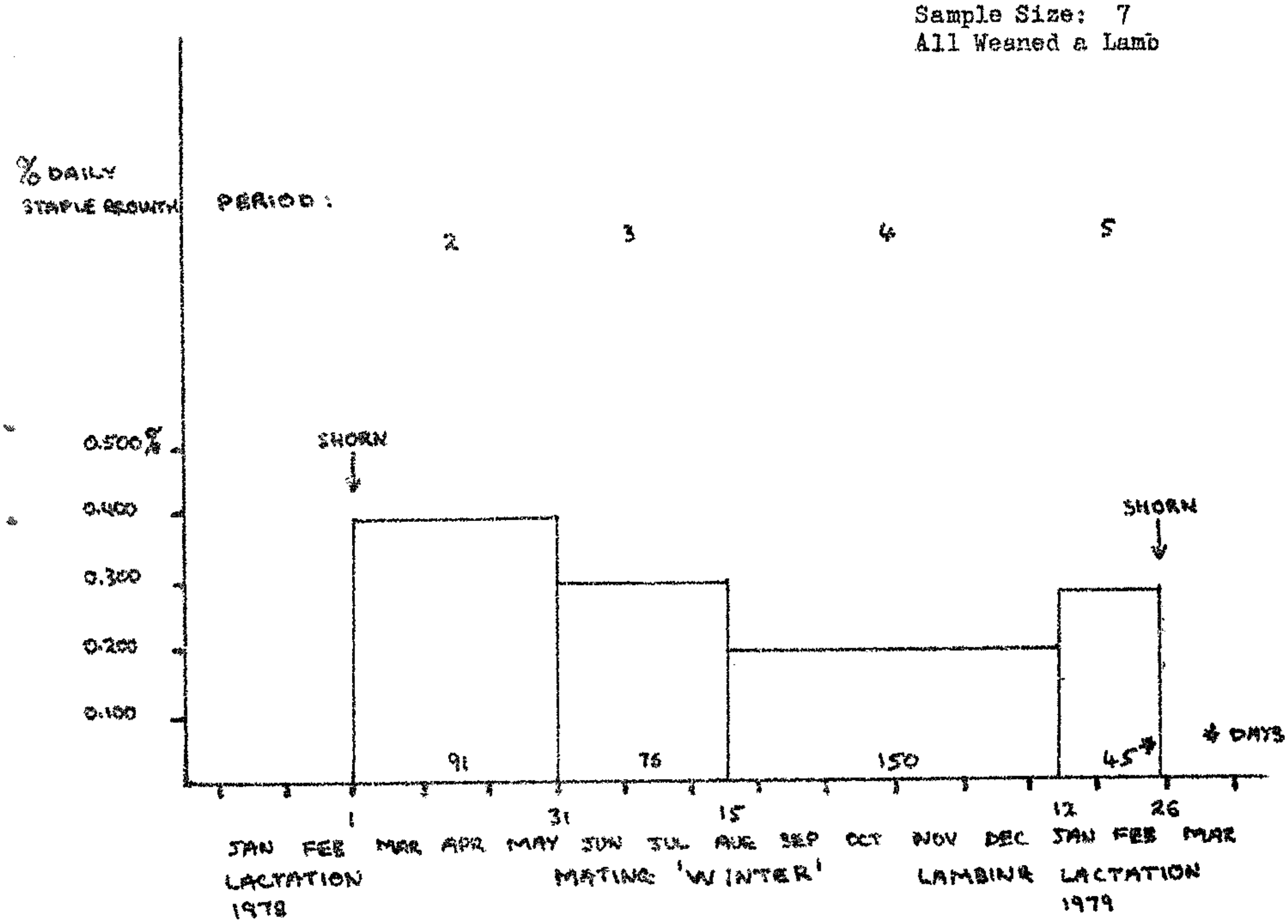


FIG 6: '73 AGE EWES (2 CROP) SHORN MARCH

Sample Size: 7
All Weaned a Lamb



T.R.M. 9/79

DATA FROM FYRGS (1.1) 78/79

78/79 SEASONAL WOOL GROWTH PATTERN - LACTATING EWES FROM FYRGS (R) (1.1) CONTROL FLOCK

Refer to Table 1B

FIG 7: '74 AGE EWES (1 CROP) SHORN JANUARY

Sample Size: 11
All Weaned a Lamb

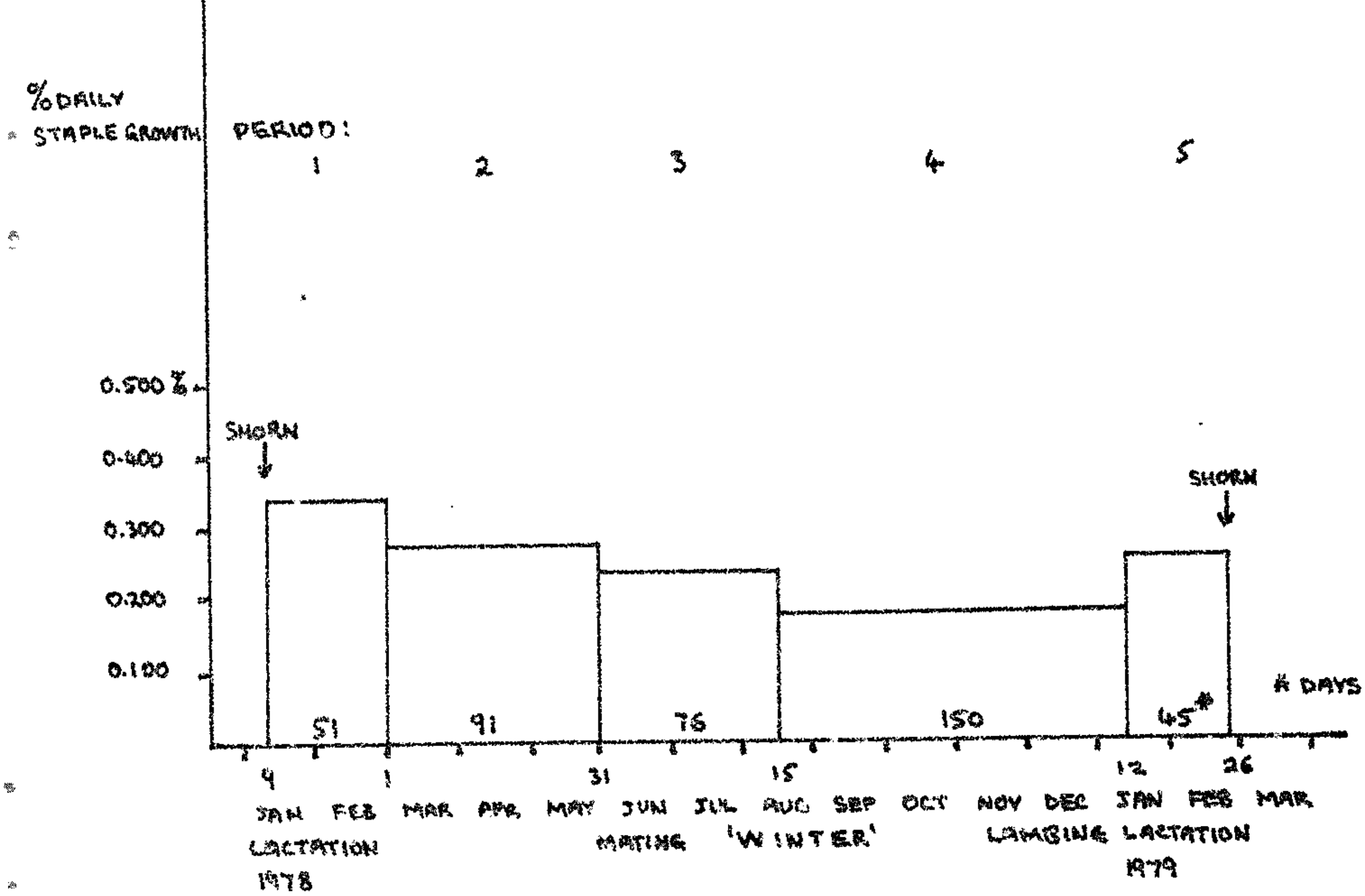
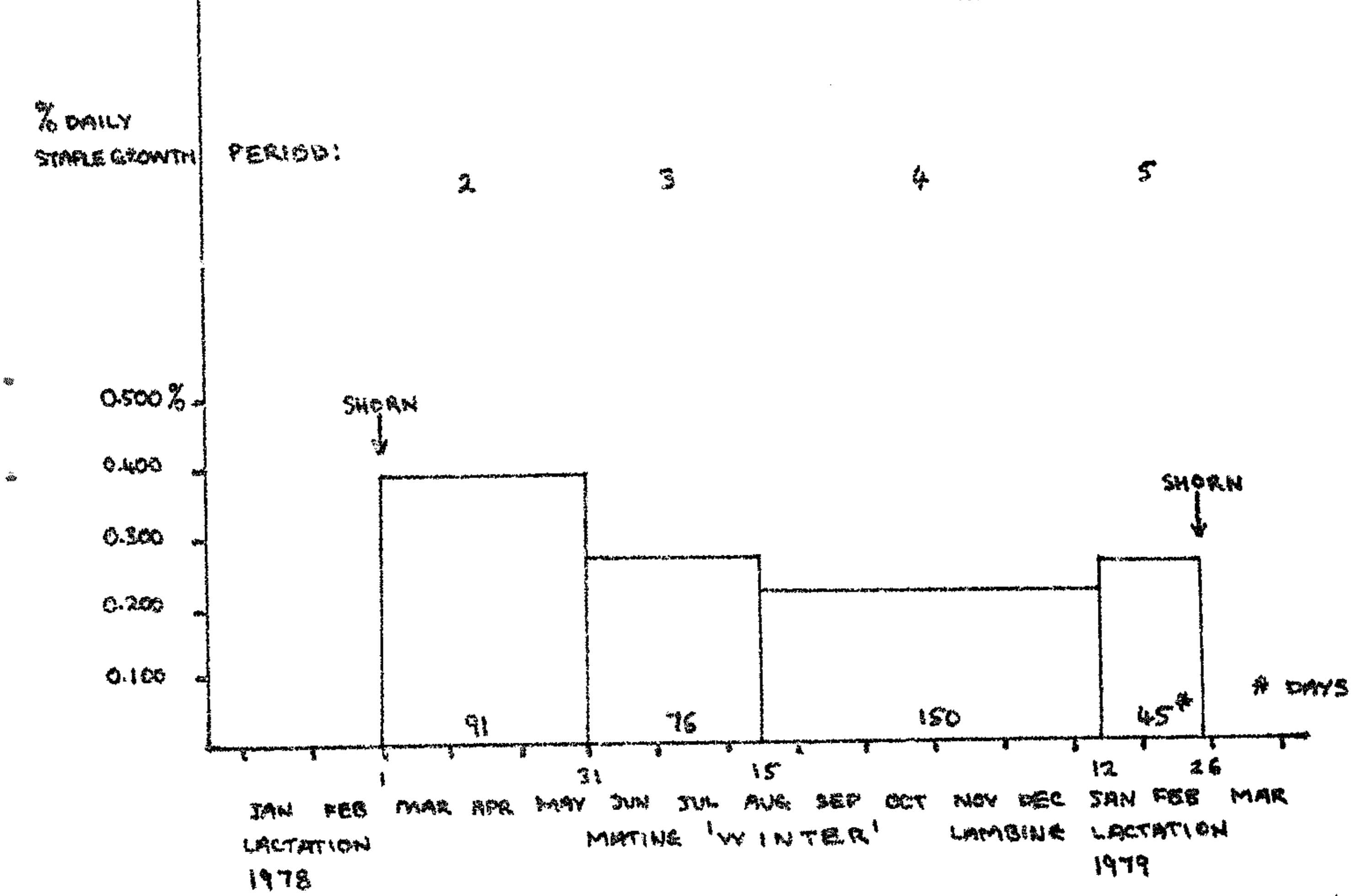


FIG 8: '74 AGE EWES (1 CROP) SHORN MARCH

Sample Size: 11
All weaned a Lamb



78/79 SEASONAL WOOL GROWTH PATTERN - LACTATING EWES FROM FYRGS (R) (1.1) TREATMENT FLOCK

Refer to Table 2

FIG 9: '71 AGE EWES (4 CROP) SHORN JANUARY

Sample Size: 4
All Weaned a Lamb

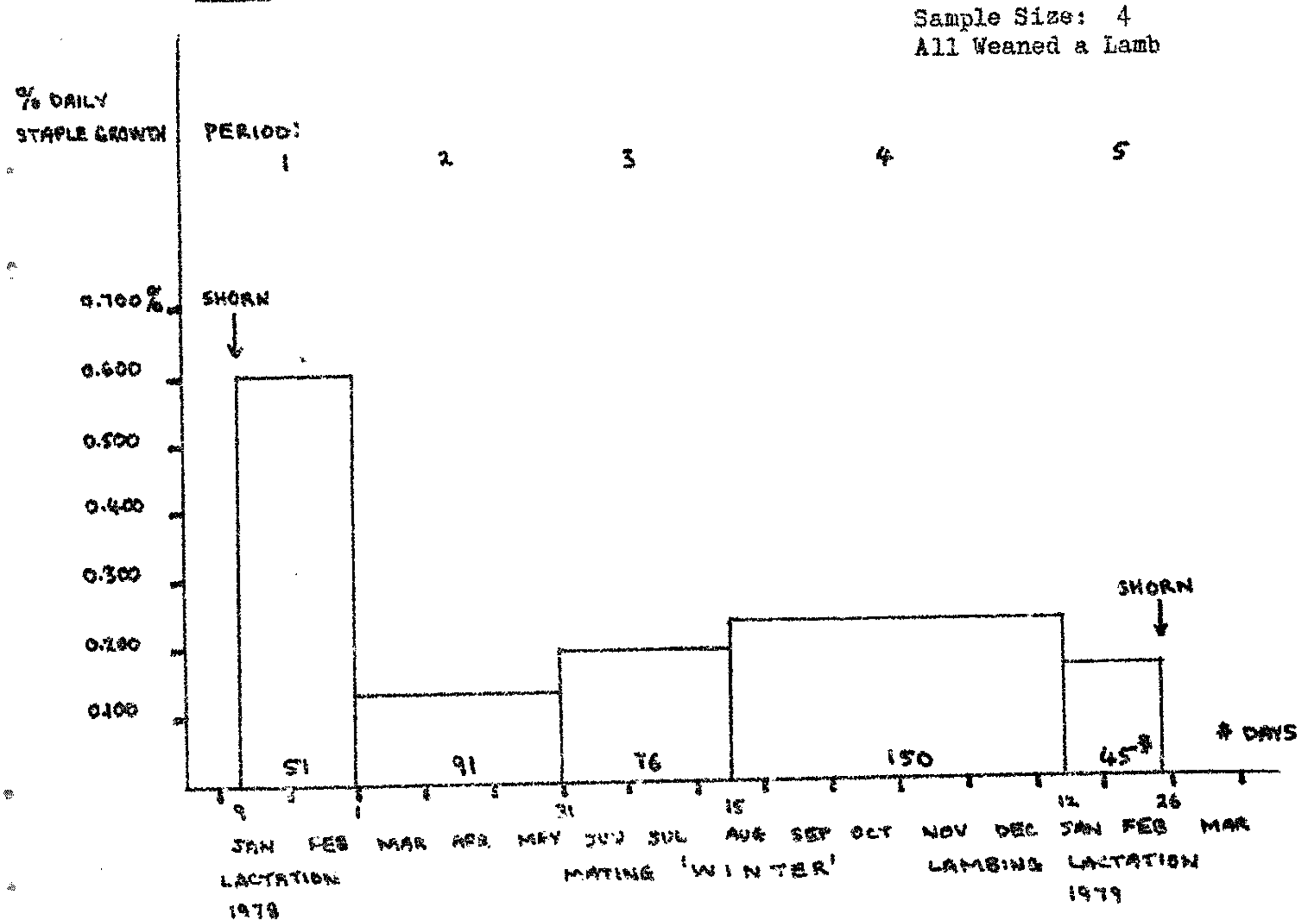
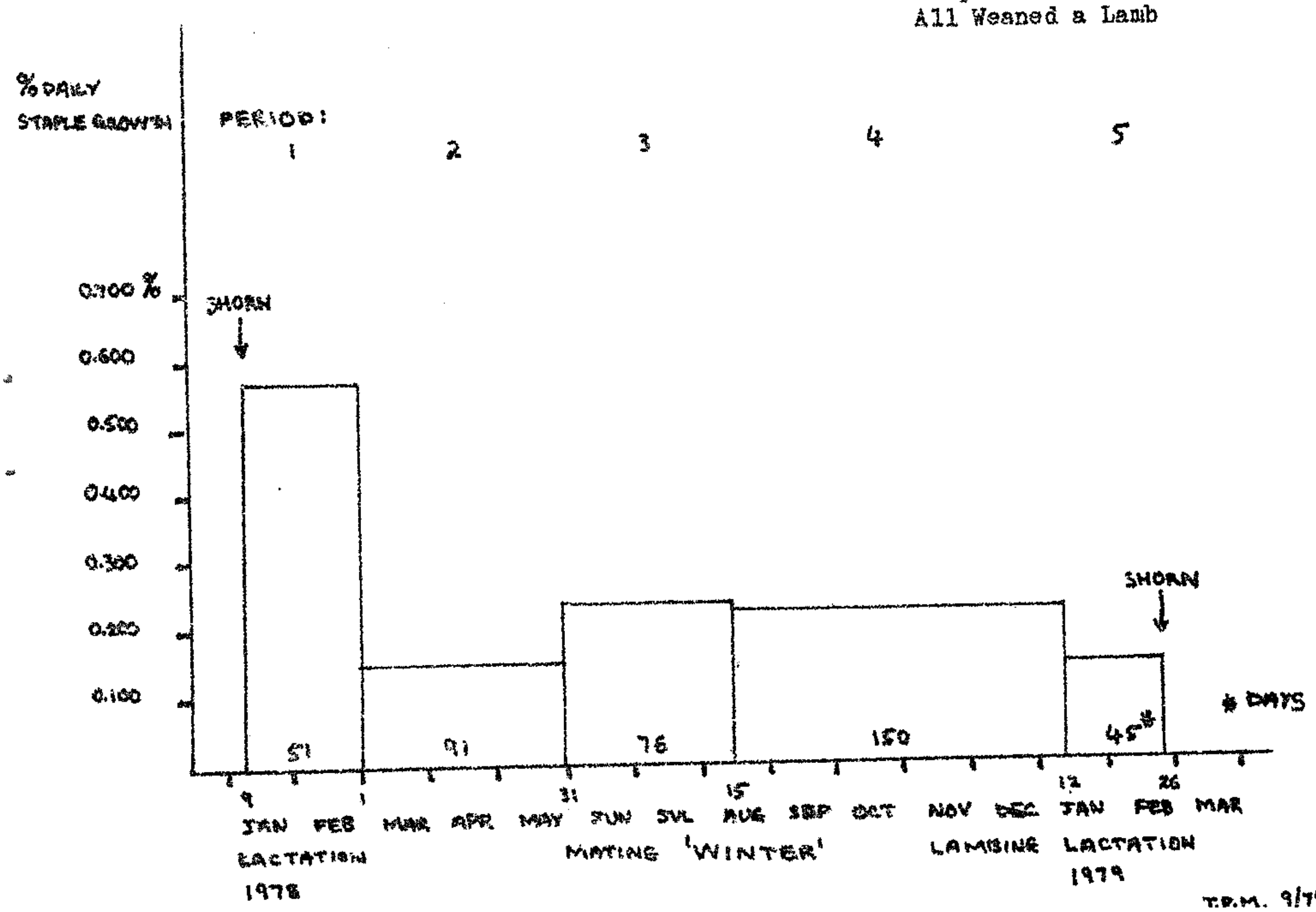


FIG 10: '72 AGE EWES (3 CROP) SHORN JANUARY

Sample Size: 5
All Weaned a Lamb



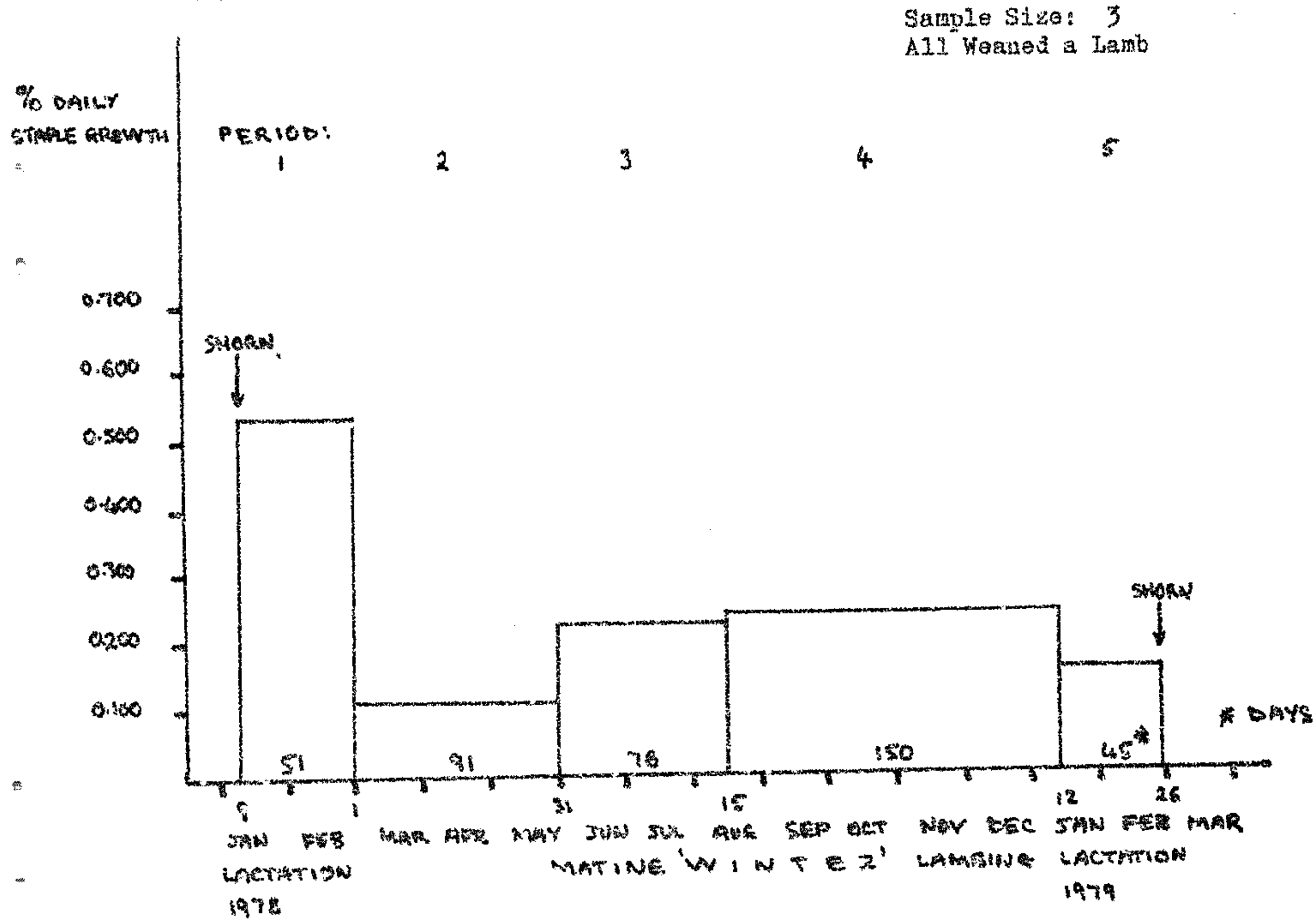
T.R.M. 9/79

78/79 SEASONAL WOOL GROWTH PATTERN - LACTATING EWES FROM FYRGS (R) (1.1) TREATMENT FLOCK

Refer to Table 2

FIG 11: '74 AGE EWES (1 CROP) SHORN JANUARY

Sample Size: 3
All Weaned a Lamb



DATA FROM FYRGS R (1.1) 78/79

78/79 SEASONAL WOOL GROWTH PATTERN - LACTATING MAIDEN EWES FROM FYRGS (R) (1.1)
CONTROL & TREATMENT FLOCKS

Refer to Table 3

FIG 12: '75 AGE MAIDEN EWES (0 CROP) CONTROL FLOCK

Sample Size: 15
All Weaned a Lamb

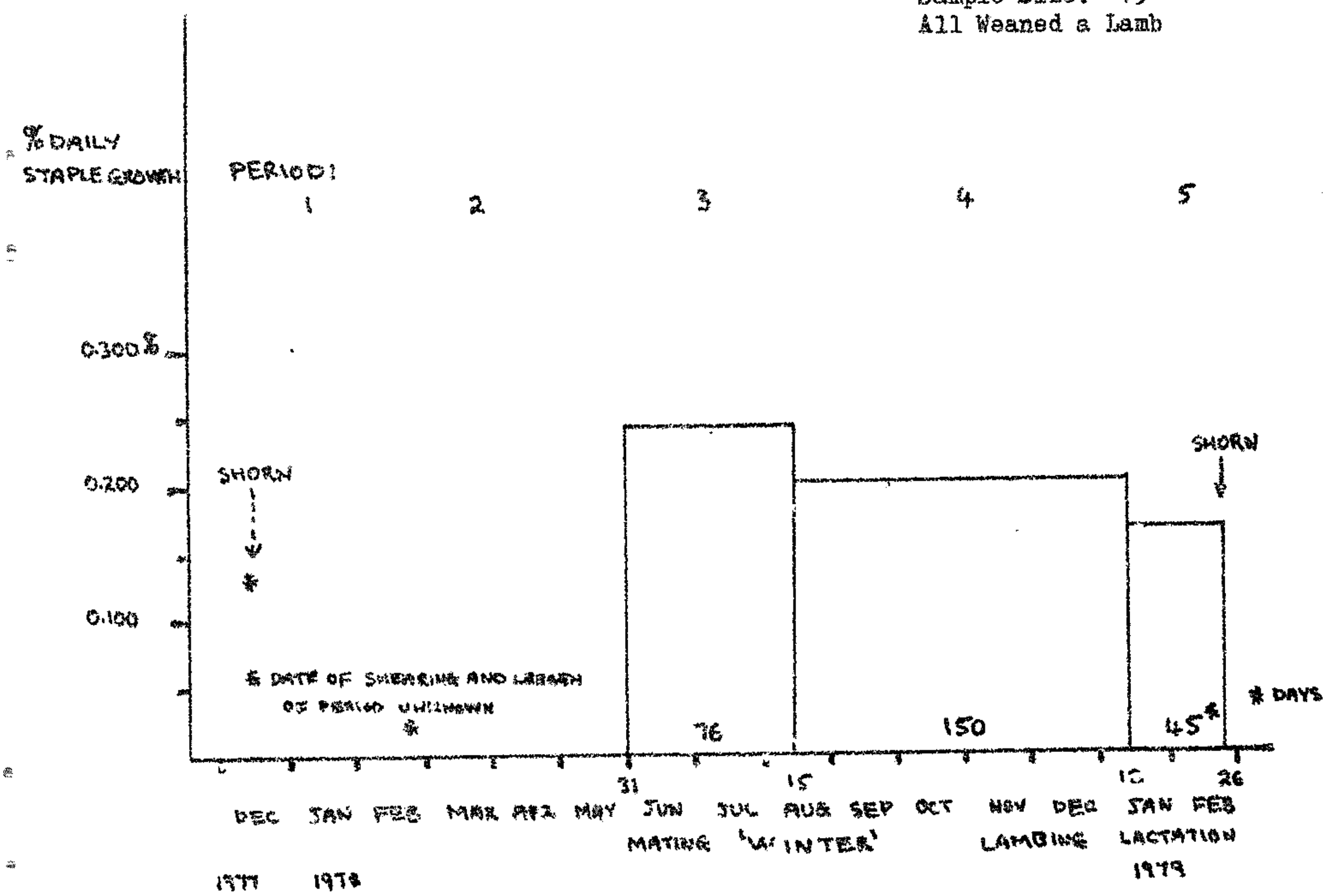
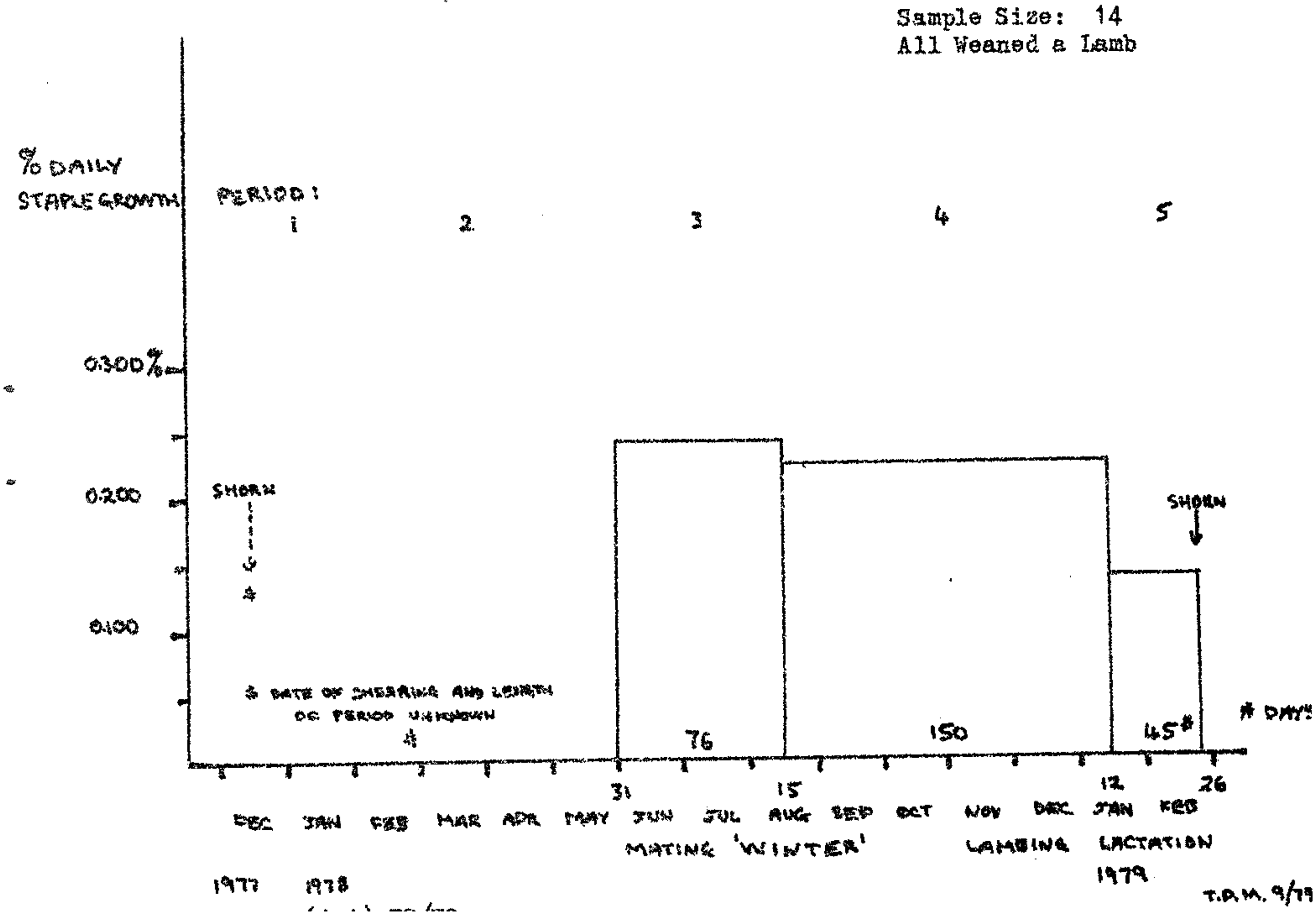


FIG 13: '75 AGE MAIDEN EWES (0 CROP) TREATMENT FLOCK

Sample Size: 14
All Weaned a Lamb



T.R.M. 9/79

78/79 SEASONAL WOOL GROWTH PATTERN - EWE & WETHER HOGGS

Refer to Table 4

FIG 14: '77 AGE EWE HOGGS

Sample Size: 22

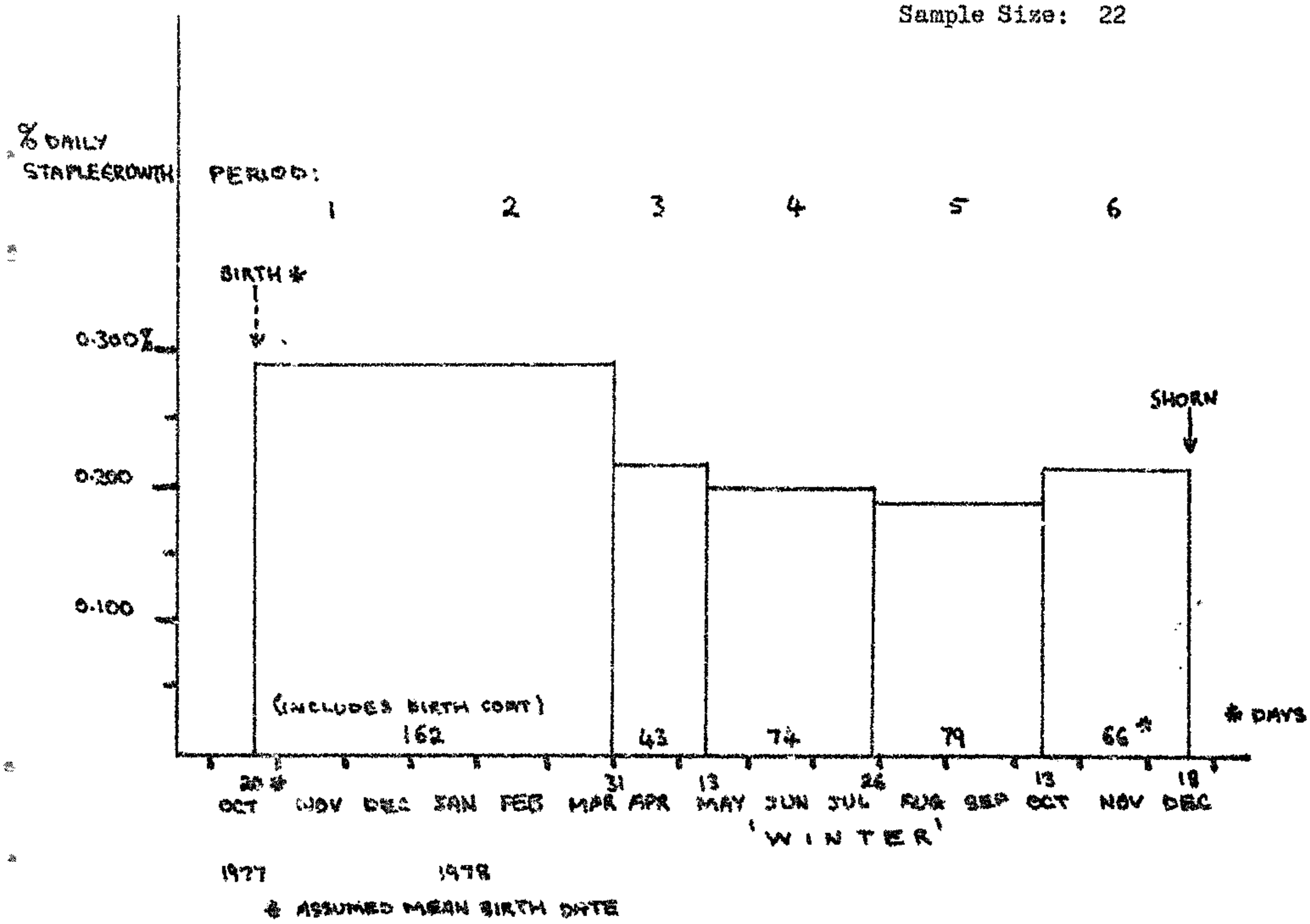
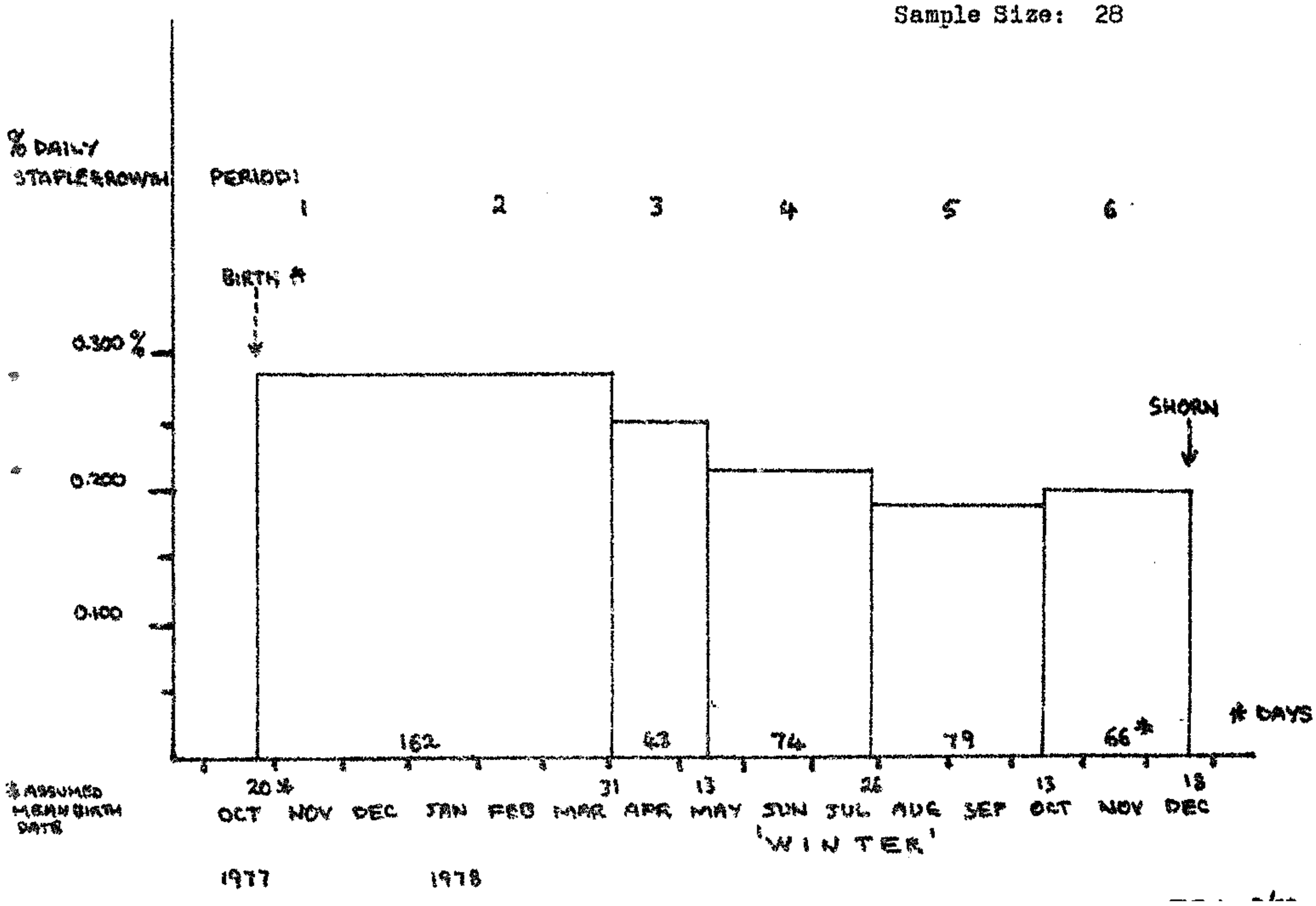


FIG 15: '77 AGE WETHER HOGGS

Sample Size: 28



78/79 SEASONAL WOOL GROWTH PATTERN - SHEARLING EWES & WETHERS

Refer to Table 5

FIG 16: '76 AGE SHEARLING EWES (1 SHEAR) SHORN DECEMBER

Sample Size: 27

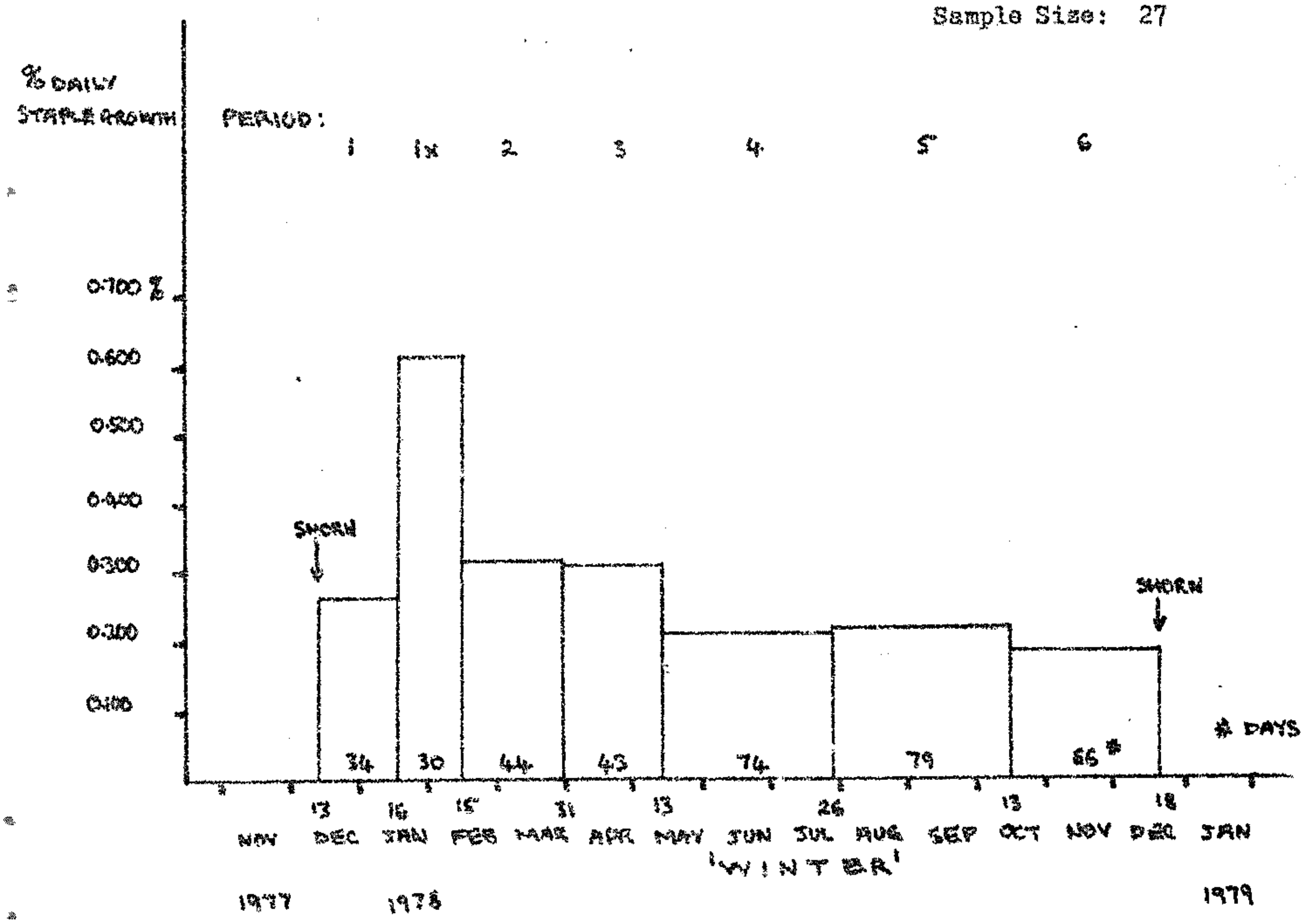
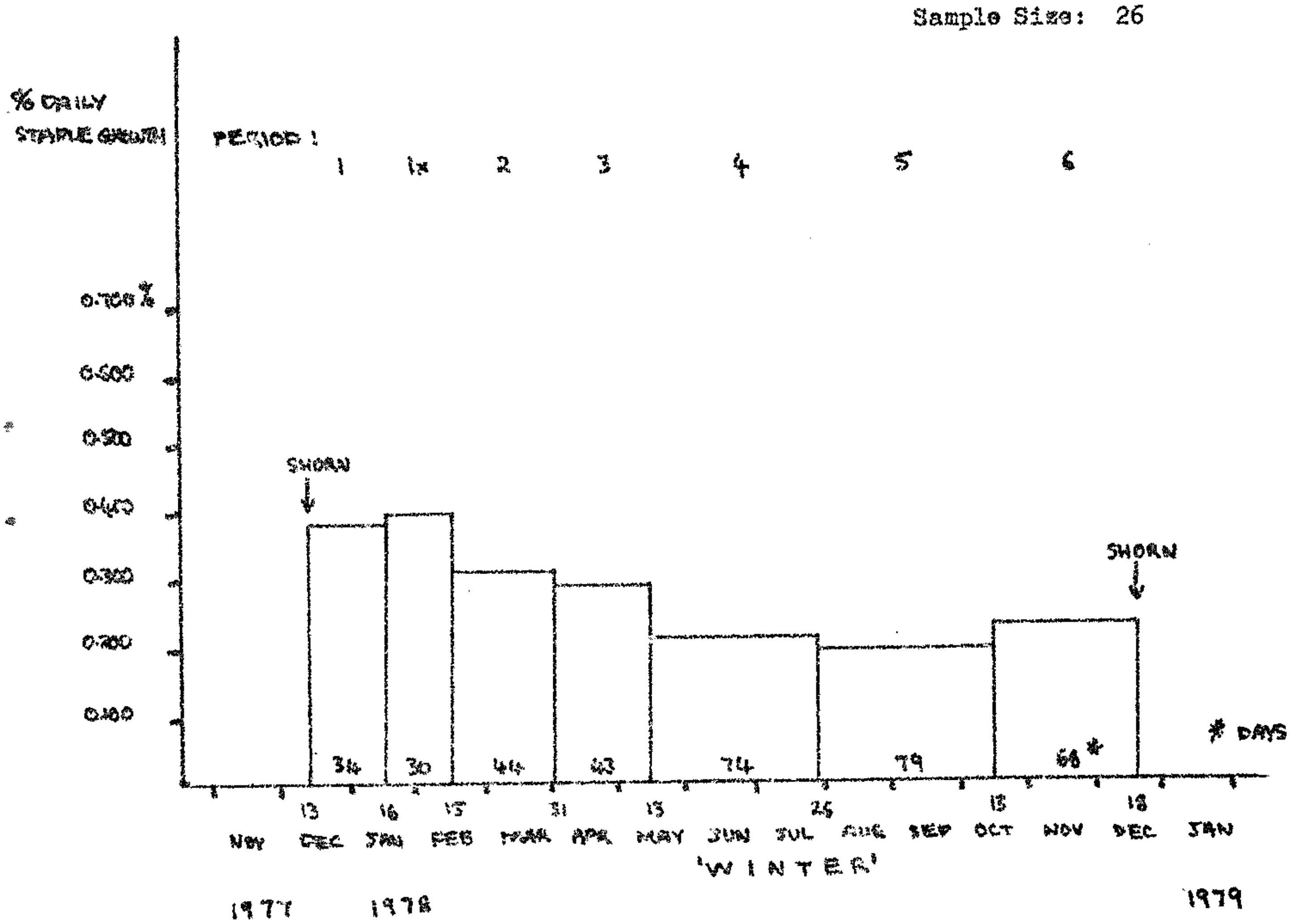


FIG 17: '76 AGE SHEARLING WETHERS (1 SHEAR) SHORN DECEMBER

Sample Size: 26



DATA FROM FYRGS D.S. N.A. (1.3) 78/79

T.P.M. 9/79

78/79 SEASONAL WOOL GROWTH PATTERN - ADULT DRY EWES

Refer to Table 6

FIG 18: '71 AGE DRY EWES (6 SHEAR) SHORN FEBRUARY

Sample Size: 5

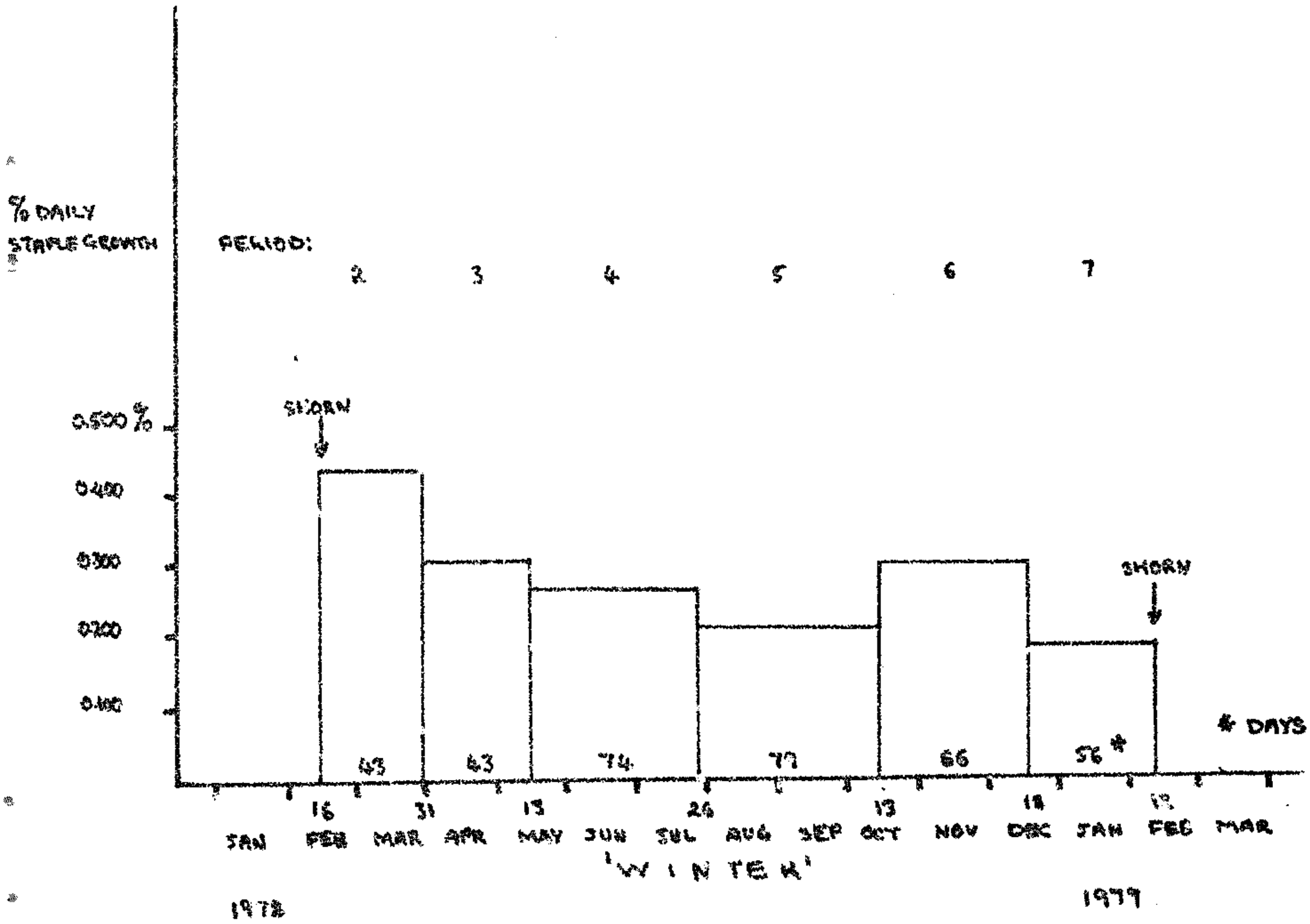
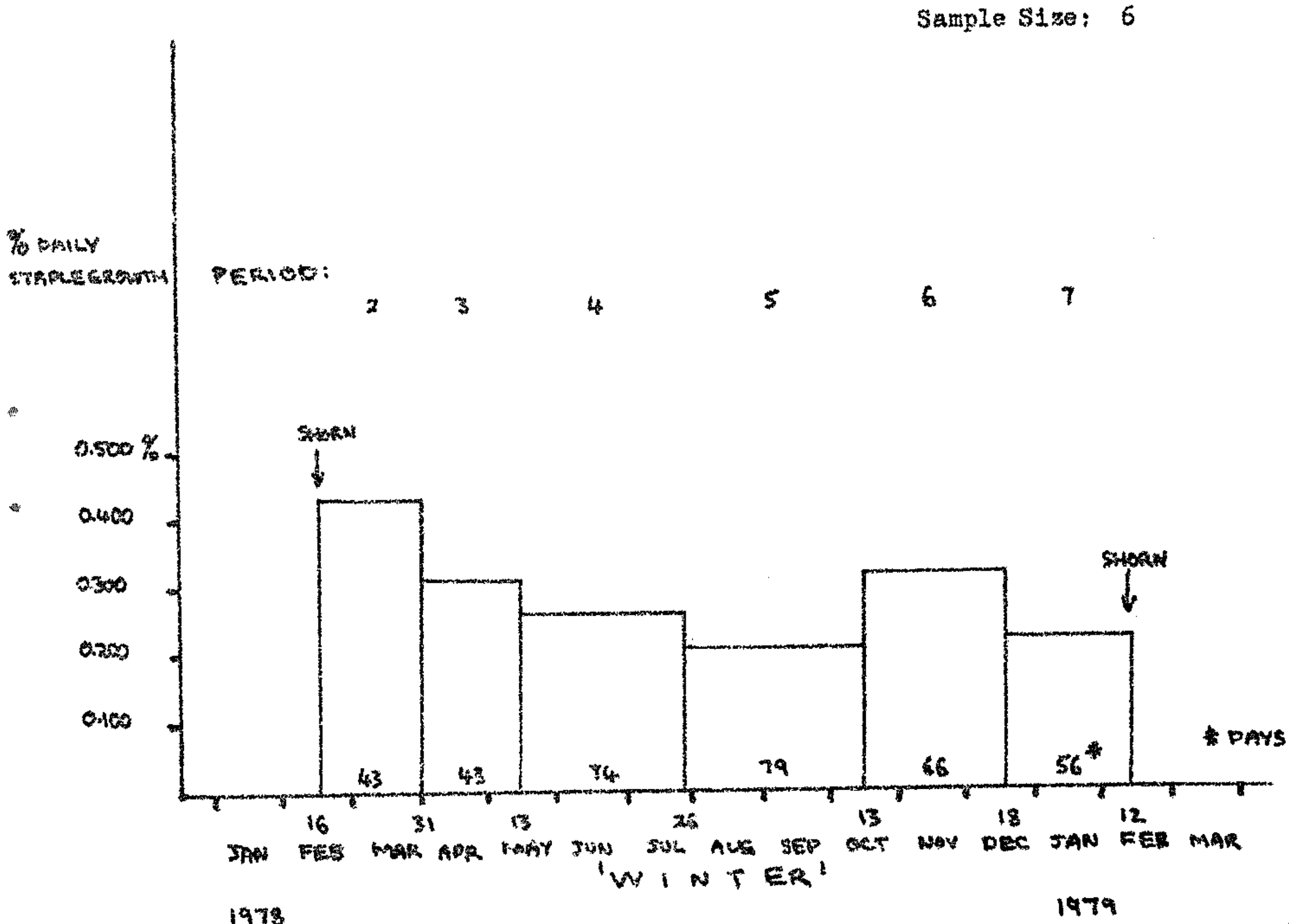


FIG 19: '72 AGE DRY EWES (5 SHEAR) SHORN FEBRUARY

Sample Size: 6



T.R.M. 9/79

78/79 SEASONAL WOOL GROWTH PATTERN - ADULT DRY EWES

Refer to Table 6

FIG 20: '73 AGE DRY EWES (4 SHEAR) SHORN FEBRUARY

Sample Size: 7

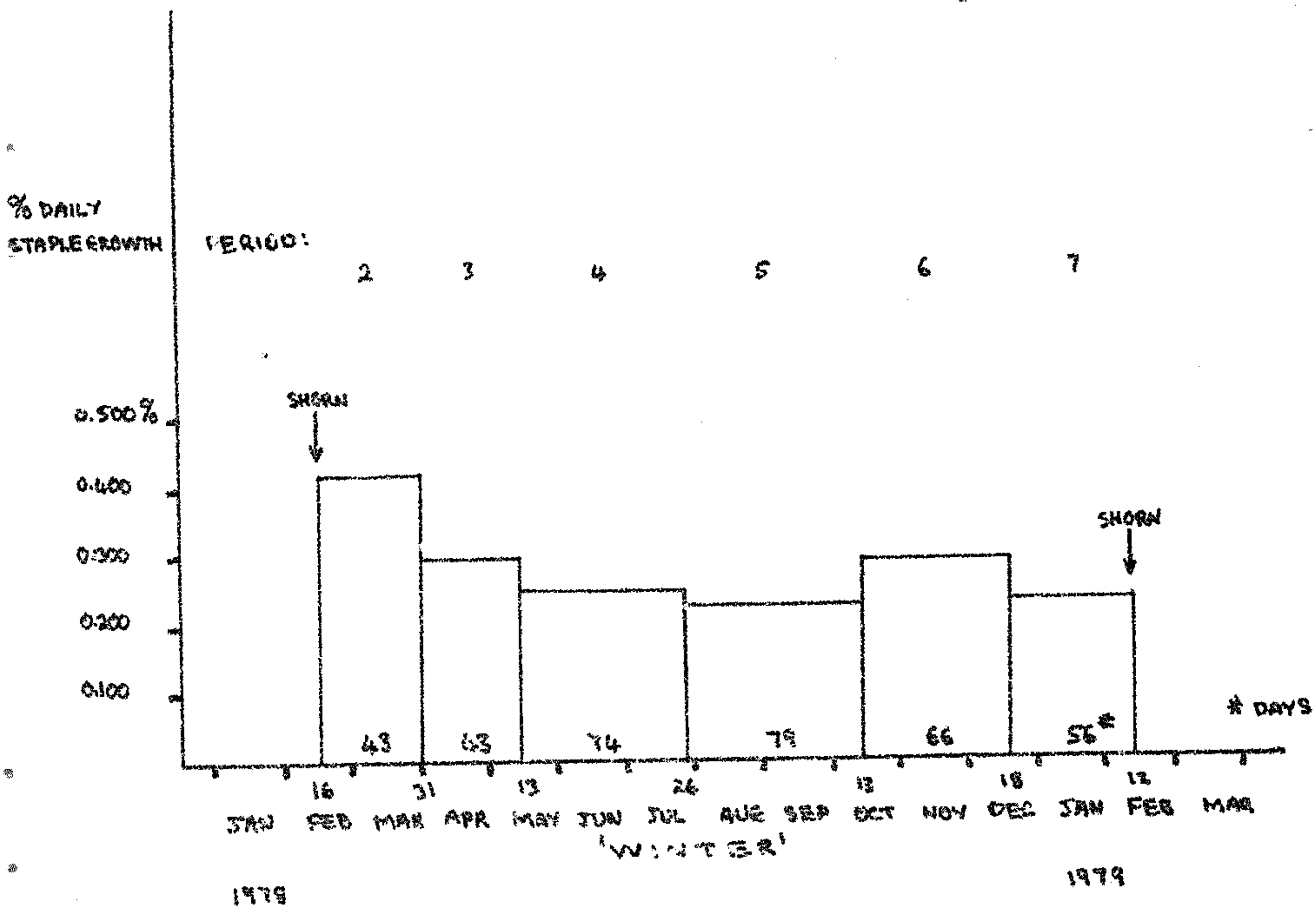
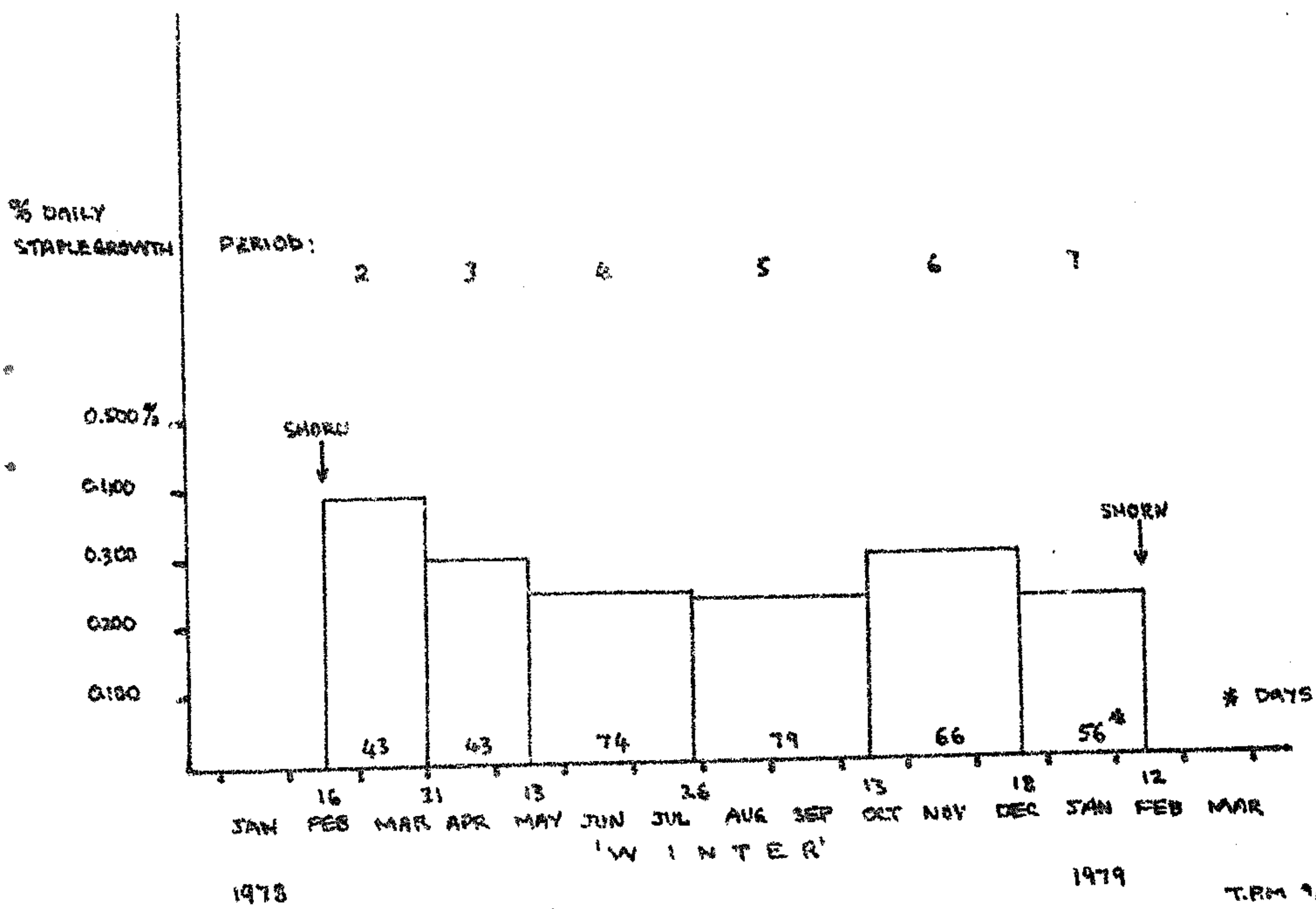


FIG 21: '74 AGE DRY EWES (3 SHEAR) SHORN FEBRUARY

Sample Size: 9



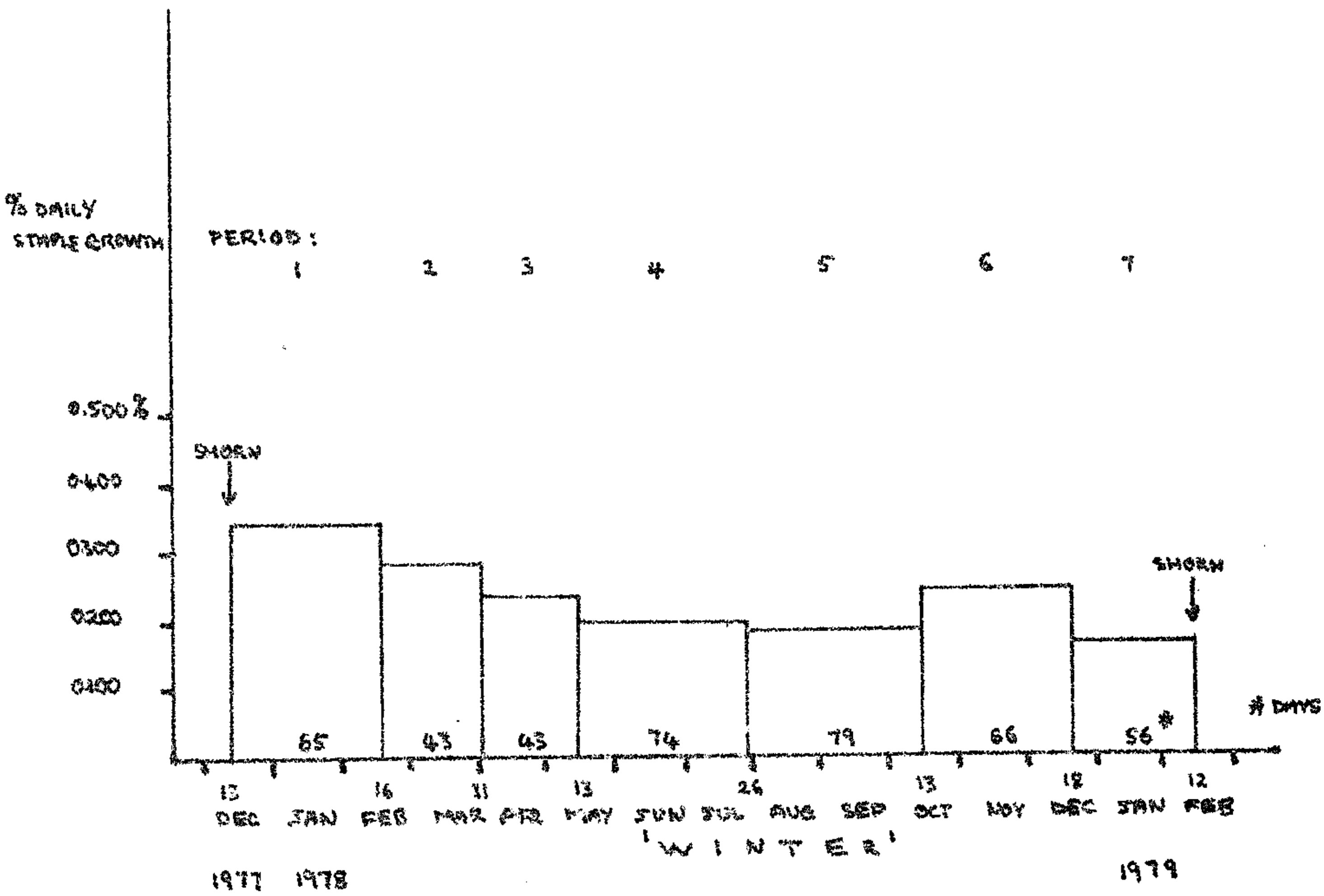
T.RM 9/79

78/79 SEASONAL WOOL GROWTH PATTERN - ADULT DRY EWES

Refer to Table 6

FIG 22: '75 AGE DRY EWES (2 SHEAR) SHORN DECEMBER

Sample Size: 3



78/79 SEASONAL WOOL GROWTH PATTERN - ADULT WETHERS

Refer to Table 7

FIG 23: '72 AGE WETHERS (5 SHEAR) SHORN DECEMBER

Sample Size: 3

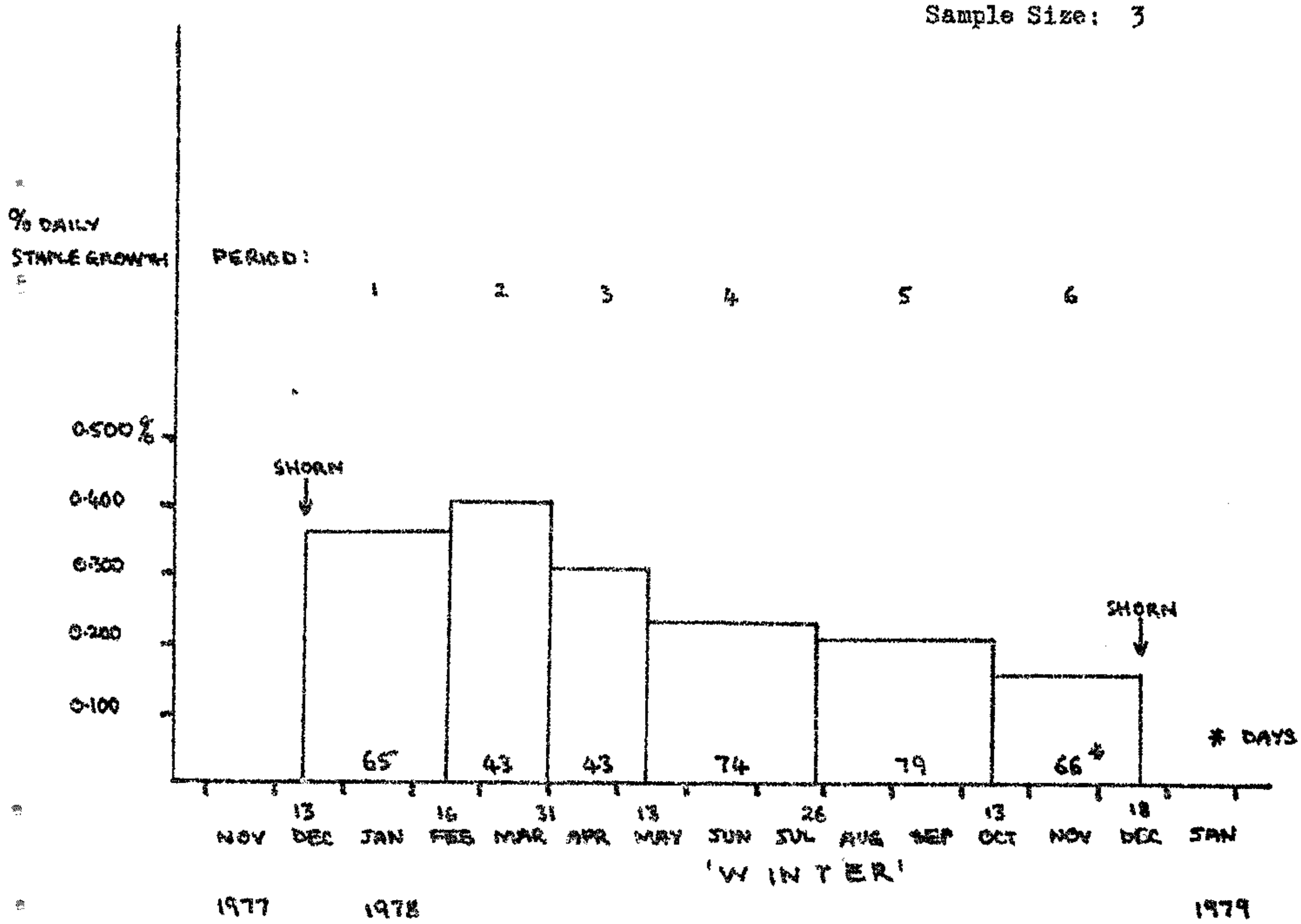
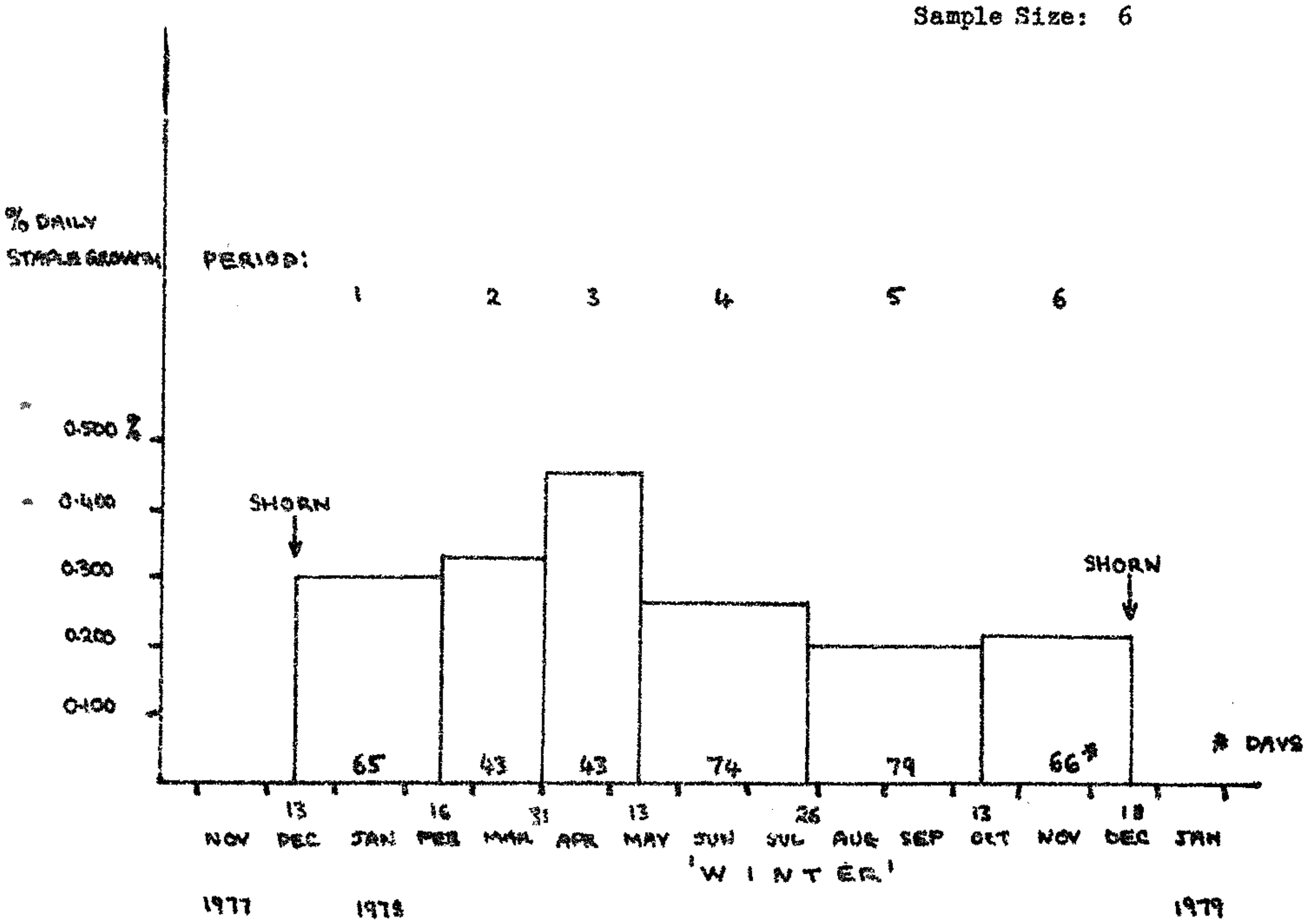


FIG 24: '73 AGE WETHERS (4 SHEAR) SHORN DECEMBER

Sample Size: 6



78/79 SEASONAL WOOL GROWTH PATTERN - ADULT WETHERS

Refer to Table 7

FIG 25: '74 AGE WETHERS (3 SHEAR) SHORN DECEMBER

Sample Size: 10

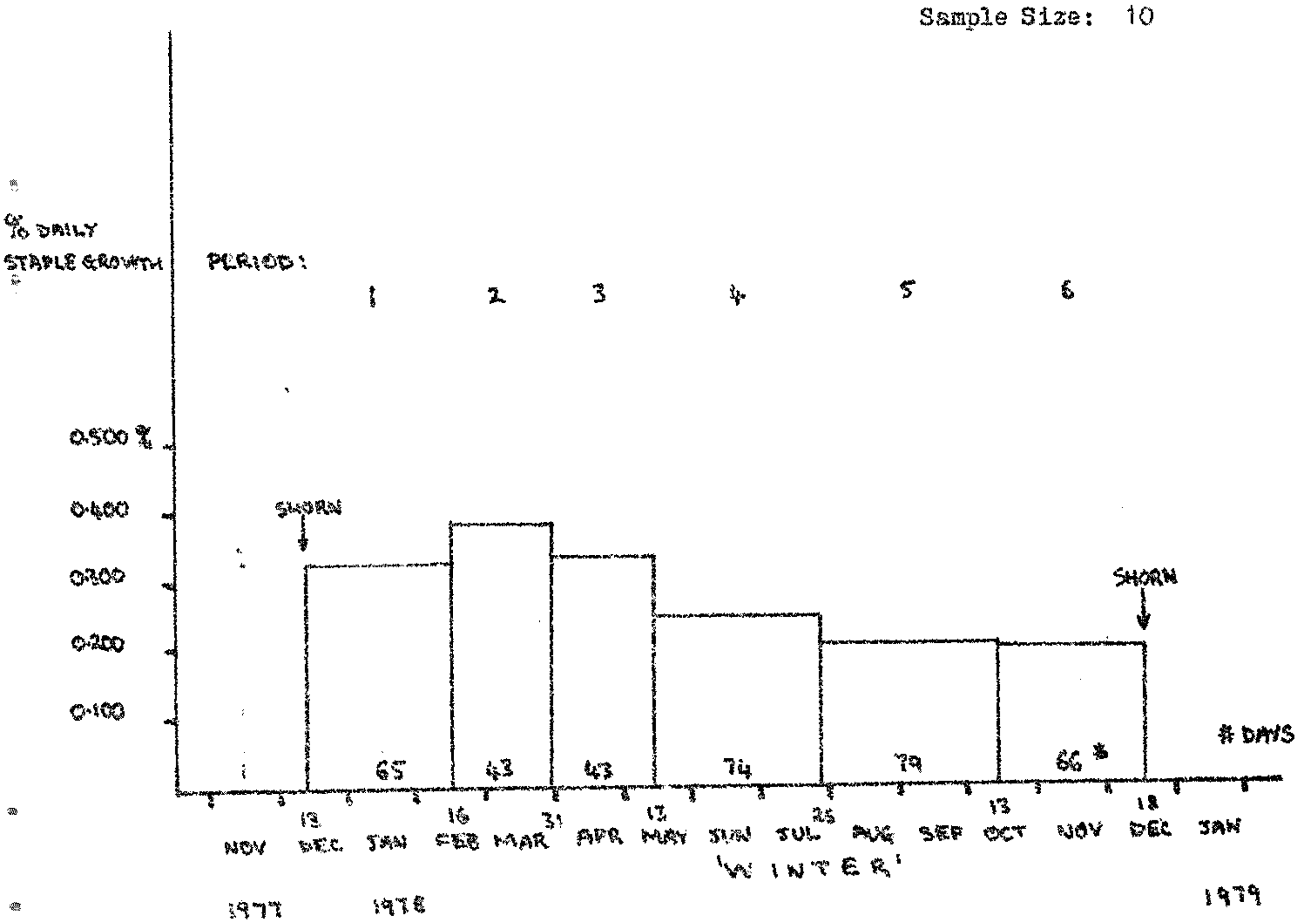
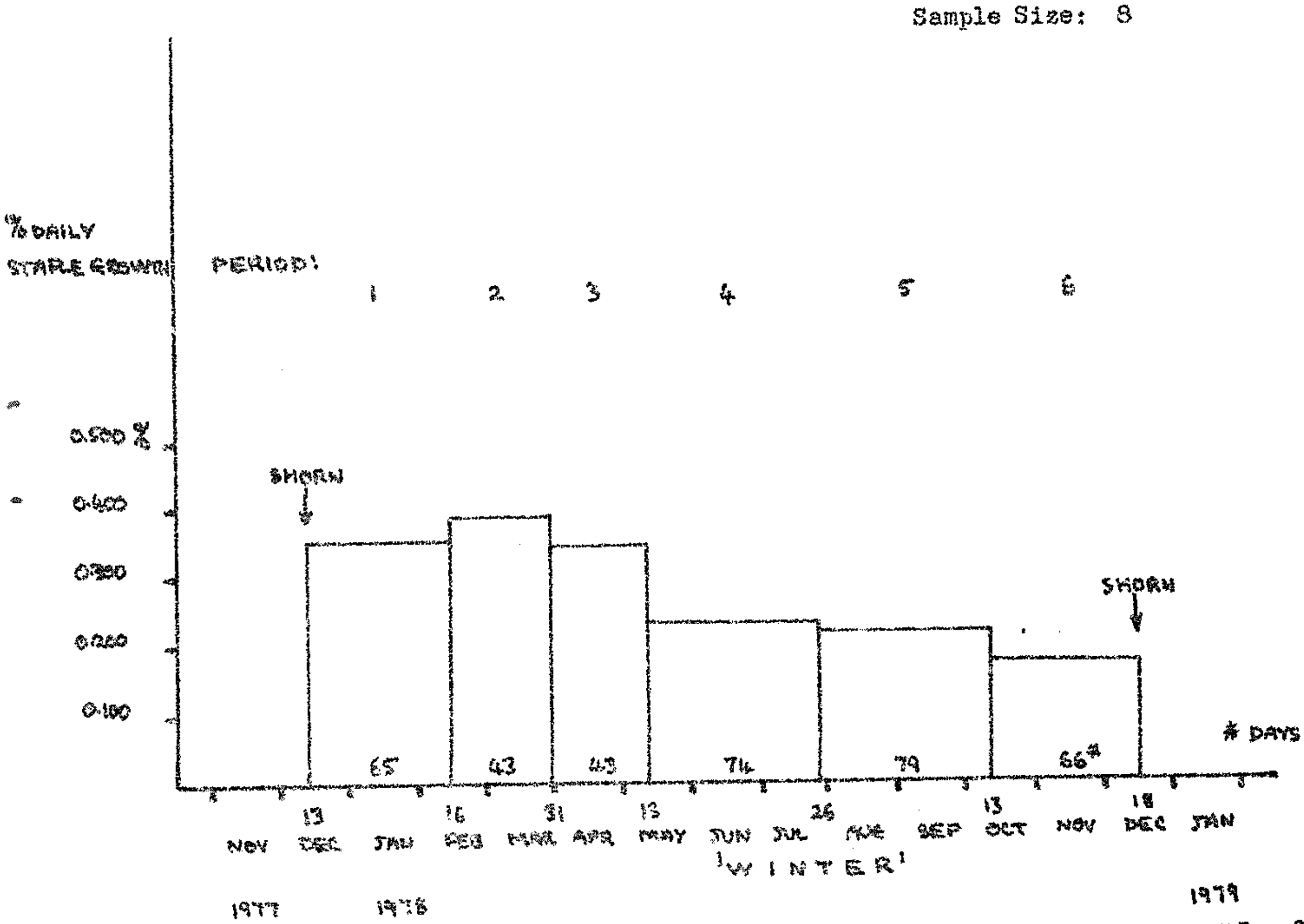


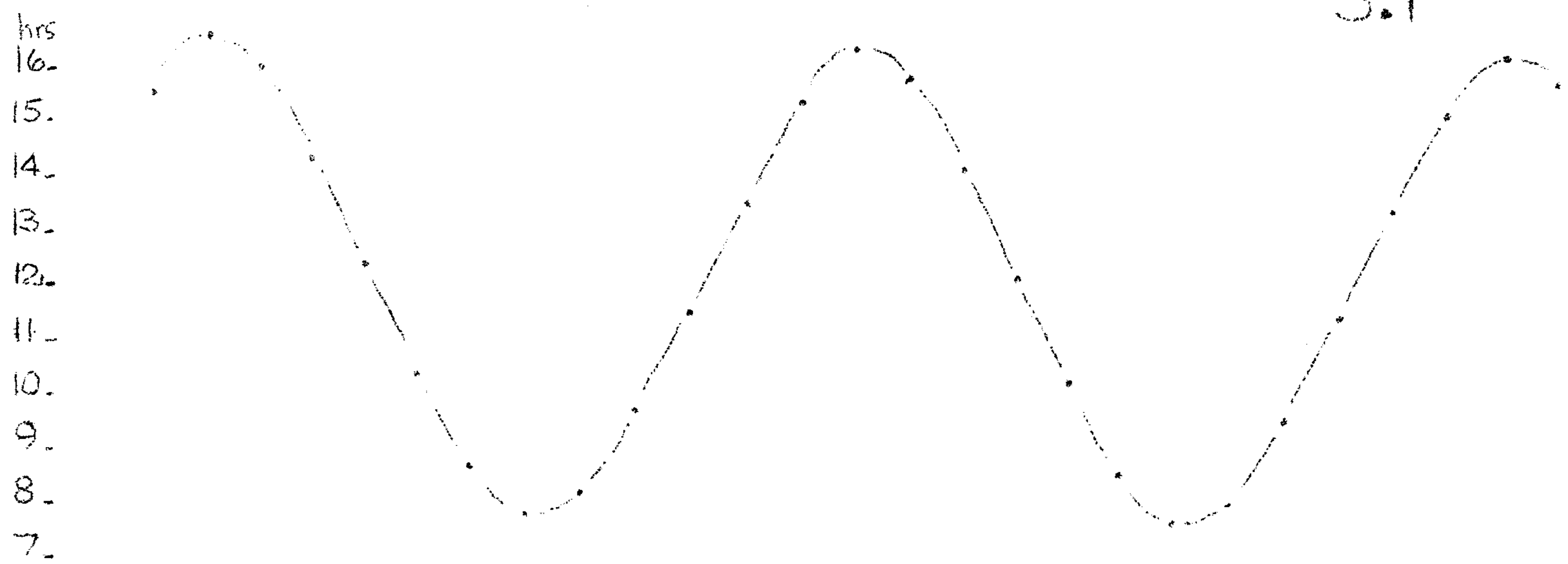
FIG 26: '75 AGE WETHERS (2 SHEAR) SHORN DECEMBER

Sample Size: 8



T.R.M. 9/79

3.1



MEAN MONTHLY DAY LENGTH (hrs) PORT STANLEY LAT 51° 42' S

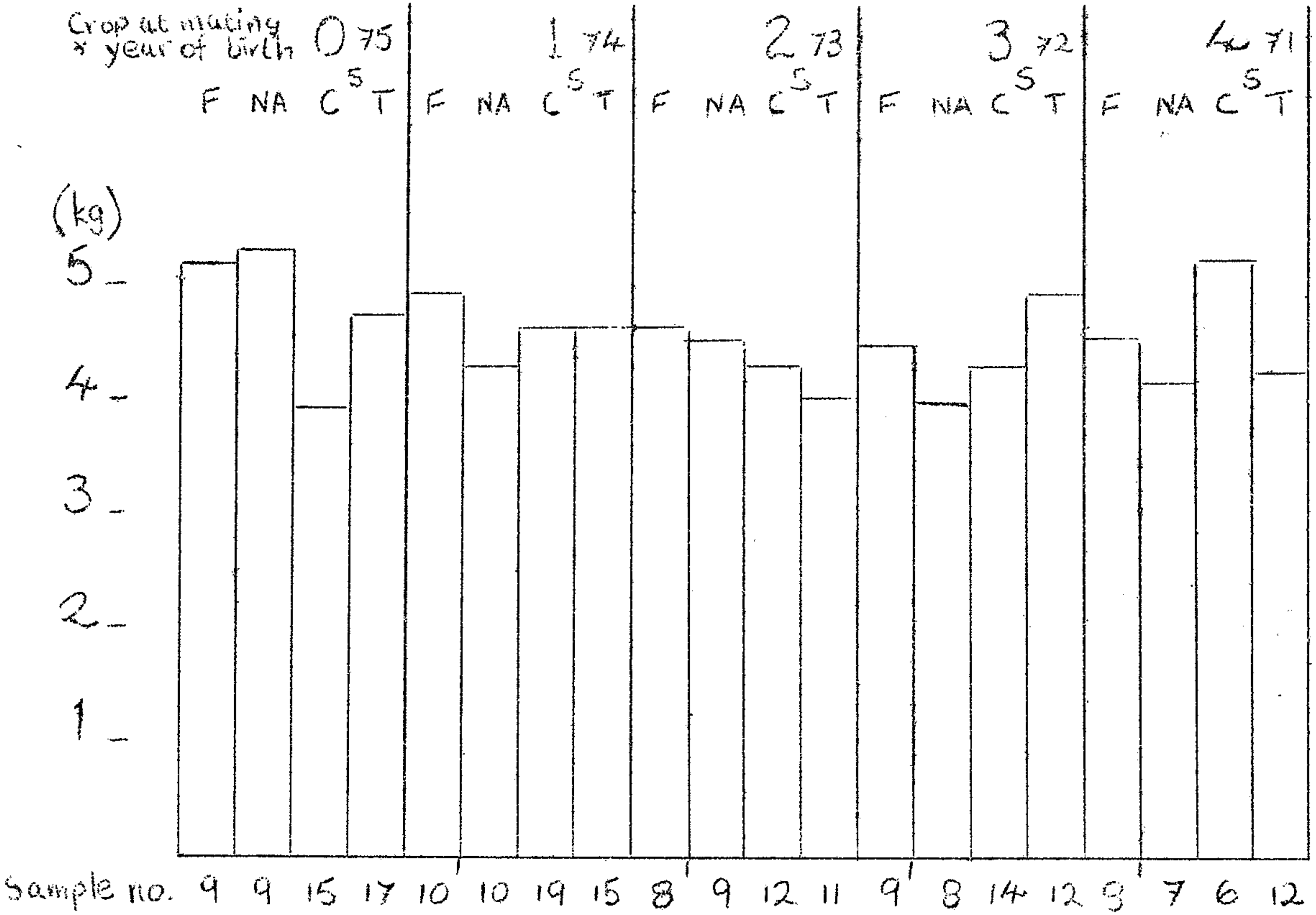
N D J F M A M J J A S O N D J F M A M J J A S O N D J

MEAN GREASY FLEECE WTS. x AGE GROUP: EWES 1978/79

3.1

F = 1.4 Fitzroy Dry Ewes NA = 1.3 N. Arm Dry Ewes 78/79

C = 1.1 Salvador and T = 1.1 Salvador ewes having reared a lamb 78/79



Appendix 3.2

3.2 PRE-PARTUM FEEDING EXPERIMENT: FOX BAY EAST

Two small flocks of ewes in five ages are compared, one of which is supplemented by grass cubes made available from five - six weeks prior to lambing commencing at 0.1kg and rising to 0.45kg/per head/day.

Object: To determine the level of nutrition necessary during the pre-partum period to influence the birth weights of lambs.

Treatments: The Control flock is set stocked and not supplemented.

The Treatment flock is set stocked and supplemented six weeks prior to lambing on a rising scale (Russel HFRO 4th Triennial Report).

Method: Details are given in this section.

Results: The results have not as yet been subject to statistical analysis.

	CONTROL		TREATMENT	
	77/78	78/79	77/78	78/79
Mean birth weight	3.3kg	3.6kg	3.6kg	3.8kg
Pre-partum period ewe weight change	+1.2kg	+3.6kg	+4.5kg	+6.3kg

Discussion: Doubtless Dickson (Davies et al 71) would in 1969 have attempted an experiment similar to this had the arrival of the Team been earlier in the year. An attempt however was made to influence lactation and wool growth during and after lambing with inconclusive results, apparently due to similar difficulties in training the animals to accept the supplement.

REF: PPFE (FBE) (5.2) 79/80

PRE-PARTUM FEEDING EXPERIMENT - FOX BAY EAST

SCHEDULE OF WORK 1979/80

WT	PROVISIONAL DATE	DAY NO.	ACTIVITIES	FLOCK	GRAZING
1	2/5/79	2	Weigh, condition score and dye band all C & T ewes Commence mating (2 rams per flock required)	C & T	N
2	15/6/79	46	Weigh, condition score and dye band all C & T ewes Remove all rams	C & T	N
3	17/8/79	109	Weigh, condition score and dye band all C & T ewes Commence feeding T ewes	C T	N S
4	28/9/79	151	Weigh, condition score and dye band all C & T ewes Lambing commences with detailed recording	C T	N S
5	16/11/79	200	Weigh, condition score and dye band all C & T ewes Weigh all lambs	C & T	N
5X	*/12/79	*	*Weigh and condition score all C & T ewes Weigh all lambs	C & T	N
6	31/1/80	276	Weigh and condition score all C & T ewes Shear all C & T ewes, recording wool weights Recover dye banding samples Cull and cast ewes removed Select, tag, weigh and condition score replacement maiden ewes Dye band all shorn ewes and maidens Weigh all lambs Mark and wean all lambs	C & T	N
7	31/3/80	335	Weigh, condition score and dye band all C & T ewes	C & T	N

* Additional weighing especially lambs - mid/late December if time permits

All dates are provisional to take account of holidays, travel delays etc.

Control ewes are referred to as C
Treatment ewes are referred to as T

Paddocks: N North Paddock
S South Paddock

PRE-PARTUM FEEDING EXPERIMENT : FOX BAY EAST 1977/78

CONTROL

YEAR OF BIRTH	SAMPLE NO.	LAMB CROP AT MATING	PRE-MATE LIVE WT(kg)	FEED PERIOD WT CHANGE	LAMBING PERIOD WT CHANGE	MEAN BIRTH WT	LAMBING PERCENTAGE	M WEAN WT	WEAN PERCENTAGE	FLEECE WT(kg)
69	9	5	43.8	-0.2	-0.9	2.9	56	17.0	44	2.0
70	9	4	44.1	+1.6	-3.0	3.4	78	16.4	67	3.1
71	10	3	41.3	+1.0	-1.5	3.8	60	19.0	40	3.1
72	11	2	43.2	+2.6	-3.9	3.1	91	20.5	91	3.2
73	10	1	43.4	+0.8	-2.7	3.4	70	18.7	40	3.5
Adult age-groups Mean			43.2	+1.2	-2.4	3.3	72	18.3	56	3.2
74	10	0	36.6	+2.0	-0.7	3.0	40	16.7	30	3.8
	59									

Lambs born 66%   Lambs weaned 62%

TREATMENT

YEAR OF BIRTH	SAMPLE NO.	LAMB CROP AT MATING	PRE-MATE LIVE WT(kg)	FEED PERIOD WT CHANGE	LAMBING PERIOD WT CHANGE	MEAN BIRTH WT	LAMBING PERCENTAGE	M WEAN WT	WEAN PERCENTAGE	FLEECE WT(kg)
69	9	5	47.7	+5.9	-1.9	3.4	67	18.2	67	3.1
70	8	4	41.5	+4.3	-1.3	3.5	62.5	17.8	62.5	2.7
71	8	3	38.4	+2.6	-2.6	3.8	75	17.6	50	3.0
72	11	2	43.5	+4.6	-3.9	3.7	100	21.4	73	3.2
73	10	1	42.7	+5.2	-3.0	3.6	100	21.9	100	3.2
Adult age-groups Mean			42.8	+4.5	-2.6	3.6	81	19.4	70.5	3.2
74	6	0	38.0	+4.9	-4.2	3.5	83	15.5	67	3.2
	52									

Lambs born 80.8%   Lambs weaned 69%

PRE-PARTUM FEEDING EXPERIMENT : FOX BAY EAST 1978/79

CONTROL

YEAR OF BIRTH	SAMPLE NO.	LAMB CROP AT MATING	PRE-MATE LIVE WT(kg)	FEED PERIOD WT CHANGE	LAMBING PERIOD WT CHANGE	MEAN BIRTH WT	LAMBING PERCENTAGE	M WEAN WT	WEAN PERCENTAGE	FLEECE WT(kg)
70	10	5	43.1	+4.4	-4.9	3.9	80	15.7	80	2.7
71	10	4	44.0	+3.2	-6.9	3.2	120	15.0	90	2.8
72	11	3	45.1	+3.2	-4.7	3.9	91	20.5	82	3.0
73	10	2	46.1	+3.3	-8.2	3.6	90	17.3	50	3.2
74	10	1	40.6	+4.1	-4.0	3.4	80	17.1	80	3.0
Adult age-groups Mean			43.8	+3.6	-5.8	3.6	94	17.1	76	2.9
75	10	0	40.2	+1.7	-2.9	3.3	80	16.7	80	3.3
	61									

Lambs born 94% Lambs weaned 80%

TREATMENT

YEAR OF BIRTH	SAMPLE NO.	LAMB CROP AT MATING	PRE-MATE LIVE WT(kg)	FEED PERIOD WT CHANGE	LAMBING PERIOD WT CHANGE	MEAN BIRTH WT	LAMBING PERCENTAGE	M WEAN WT	WEAN PERCENTAGE	FLEECE WT(kg)
70	8	5	48.9	+6.3	-1.7	3.9	100	17.7	62.5	2.75
71	8	4	45.4	+6.8	-4.3	4.0	75	18.4	75	2.9
72	11	3	44.7	+6.3	-6.0	3.7	109	18.9	100	2.9
73	9	2	46.4	+6.1	-4.6	3.75	89	21.9	89	3.4
74	8	1	40.4	+6.2	-2.2	3.6	50	19.6	50	3.1
Adult age-groups Mean			45.2	+6.3	-3.8	3.8	85	19.3	75	3.0
75	5	0	42.6	+4.3	-5.2	3.2	100	17.9	80	3.7
	49									

Lambs born 88% Lambs weaned 75%

REF: PPFE (FBE) (3.2) 79/80

PRE-PARTUM FEEDING EXPERIMENT - FOX BAY EAST

SCHEDULE OF WORK 1979/80

WT	PROVISIONAL DATE	DAY NO.	ACTIVITIES	FLOCK	GRAZING
1	2/5/79	2	Weigh, condition score and dye band all C & T ewes Commence mating (2 rams per flock required)	C & T	N
2	15/6/79	46	Weigh, condition score and dye band all C & T ewes Remove all rams	C & T	N
3	17/8/79	109	Weigh, condition score and dye band all C & T ewes Commence feeding T ewes	C T	N S
4	28/9/79	151	Weigh, condition score and dye band all C & T ewes Lambing commences with detailed recording	C T	N S
5	16/11/79	200	Weigh, condition score and dye band all C & T ewes Weigh all lambs	C & T	N
5X	*/12/79	*	*Weigh and condition score all C & T ewes Weigh all lambs	C & T	N
6	31/1/80	276	Weigh and condition score all C & T ewes Shear all C & T ewes, recording wool weights Recover dye banding samples Cull and cast ewes removed Select, tag, weigh and condition score replacement maiden ewes Dye band all shorn ewes and maidens Weigh all lambs Mark and wean all lambs	C & T	N
7	31/3/80	335	Weigh, condition score and dye band all C & T ewes	C & T	N

* Additional weighing especially lambs - mid/late December if time permits

All dates are provisional to take account of holidays, travel delays etc.

Control ewes are referred to as C
Treatment ewes are referred to as T

Paddocks: N North Paddock
S South Paddock

MATING PERFORMANCE SALVADOR. 1977, 1978

	FLOCK	CONTROL			TREATMENT		
	AGE	Maidens	Adults	Total	Maidens	Adults	Total
Percentage of ewes served in the first 17 days of mating which lambed	1977	92	96	95	91	99	98
	1978	97	97	97	78	91	89
Percentage of ewes which repeated and which lambed	1977	67	81	77	57	87	68
	1978	100	79	84	43	82	70

OVULATION RATE OF BREEDING EWES AT NORTH ARM 1978

Summary

An investigation at North Arm between April and August 1978 to observe the pattern of ovulation in 3 ages of ewes during the period when such sheep are most likely to be mated and to obtain details of their body weight changes, carcase weights, killing out percentages and chest depths.

Unfortunately, two rams broke into the ewe flock and successfully mated with at least 33 ewes thus making accurate interpretation of the results difficult.

The overall pattern was one of maintenance of body weight until July when a sharp decrease ocurred. Ovulation rate peaked at about 130% in late May and thereafter steadily decreased and the incidence of anoestrus increased from 0% in early July up to 66% in August at the end of the investigation.

The Grasslands Trials Unit original date for the onset of mating in their flocks would overlap with this period of rising incidence of anoestrus.

It is shown that maiden ewes at 2½ years of age have not reached their mature body weight. Overall the mature ewes on this farm had a carcase weight of approximately 18kg, and chest depth of 28cm and a killing out percentage of 44%.

Object

A small pilot study in 1977 in which farms were requested to collect ewes uteri and ovaries for subsequent examination, indicated an ovulation rate of about 130%. Unfortunately the method of this study was such that little credance can be given to that value as an accurate indicator of the real situation.

The object of this investigation was to observe the pattern of ovulation rate in 3 ages of ewes during the period when they are most likely to be mated to obtain details of their mean body weight changes, carcase weights, chest depth and killing out percentages.

Method

From a flock of ewes culled for wool or conformation faults 6 groups were formed composed of one group of 67 and one group of 16 from each of the maiden, 1-crop and 2-crop ewes born in 1975, 1974 and 1973 respectively, each sheep having a random chance of being allotted to either group within the age-groups.

The three groups of 16 sheep were run in a small camp near the settlement and were weighed each Monday morning to obtain details of weight change patterns with the season.

The three groups of 67 sheep were run together in a separate camp. The original intention was to withdraw 10 ewes each week, randomly selected, so that 3 each of two age groups and 4 ewes of the other would be slaughtered each Monday. In the event, however, 20 ewes were withdrawn with 10 being slaughtered and the remaining 10 being held for the next week's killing.

Prior to slaughter the ewes' body weights and chest depth (at maximum size) were recorded. After slaughter, the carcase weight (dressed carcase with head and kidneys) was recorded and the uterus and ovaries from each ewe stored in 10% formaldehyde solution for later examination.

The ovaries were examined by dissection and the most recent event in the cycle of ovarian function - adjudged purely by details of the corpora lutea - was recorded. No measurements were made to estimate the age of the corpora lutea. A brief examination of the uterus was made.

Results and Discussion

The results are confused by the fact that two rams were found in the slaughter group on 15th May and, although it is not known for how long they had been in with the ewes, it is thought that it was probably not more than 14 days. Nevertheless as can be seen from Table 1 a total of 33 ewes are known to have been mated and held to the service by these rams representing 24.2%, 15.4% and 10.8% of the ewes available in the 2-, 1-, and 0-crop groups respectively. (The disparity between the original 67 ewes in each group was due to the unidentified presence of some wethers).

The ewes which are known to have been in lamb were deleted from all calculations leaving 50, 55 and 58 in the 2-, 1-, and 0-crop groups respectively.

The mean weights of all these ewes on 1st April 1978 is shown in Table 1 and may be compared with the mean weights of the 16 ewes weighed every week (shown in Table 2).-

Mean Weight on 1st April 1978

	0-crop	1-crop	2-crop
Weighed groups of 16	36.8kg	43.4kg	44.7kg
Remainder of groups of 67	33.6kg	40.2kg	40.6kg

Although the smaller groups appear to have had a higher mean weight at the outset of the investigation, the high coefficients of variation of these values indicate that the two samples are most probably from the same population in each age group.

The progress of the groups which were weighed every week is shown in Table 2 and in Figure 1. It is apparent that not only are the mean body weights of the 3 age groups in a distinct scale but also the coefficients of variation (CV) of these body weights are in a scale with the younger age group having the lowest CV. Although some of the variation in mean body weight is due to the sheep being weighed when their fleeces were wet (on 17th April, 1st May, 3rd, 10th & 17th July), the overall trend is a sharp decrease in body weight at the beginning of July onwards. Examination of the meteorological data from Stanley (not shown) gives no easy explanation and this decrease in body weight is probably a function of the combination of cold wet weather and advancing winter period. The disparity in mean body weights of the maiden ewes and the other ages must be taken as signifying incomplete maturity of the youngest age group.

The mean change in body weight of the ewes slaughtered each week as compared to their body weights on 1st April is shown in Figure 2. The values are those for all the slaughtered sheep together are not separated into age groups due to the deletion of pregnant ewes making the groups killed each week too small. The overall picture is much the same as that shown by the weekly weighings of the smaller groups (Figure 1) indicating that the samples of each group slaughtered each week could be regarded as being representative of the flock situation.

Turning to the percentage of corpora lutea per ewe, and the percentage of ewes recorded as being in anoestrus, shown in Figure 2 with details in Table 3, it can be seen that the ovulation rate (judged by presence or absence of corpora lutea of similar sizes) appears to peak in middle-end of May with a distinct tail-off in July. Obviously a compounding influence on this pattern was the presence of 2 rams detected on 15th May which also happens to be the day of the highest recorded ovulation rate. What influence these rams may have had on ovulation rate may only be surmised but it is possible that after an initial stimulation, there was a secondary depression 5th, 12th & 19th June following the rams' removal.

The ewes were regarded as being in anoestrus if neither of their ovaries showed signs of recent function in terms of presence of corpora lutea or follicles. Whilst this method of classification may be up to 18 days behind "schedule" (the assumed period of death of a corpus luteum), it does give a picture of the flock situation.

The Grasslands Trials Unit's flock at Bronton Loch and Ronda were first mated (in 1976) on 21st June (midwinter) which means that some of the ewes (assuming these two flocks to be similar as the North Arm flock) would come into a mateable season for the first time during the period when the incidence of anoestrus was increasing. The two trial flocks are now mated starting on 5th June but this is still dengerously near the beginning of the anoestrus period. These details, however, should be treated with some caution because of the devastation wrought by the two rams.

Further details of the ewes physiology are shown in Table 1 with the mean carcase weights of approximately 16 and 19 kilograms and chest depths of 26 and 28 centimetres for maiden and 'adult' ewes respectively with a killing out percentage of approximately 44% for all ages.

Acknowledgements: The staff of North Arm, in particular Mr. Nigel Knight are to be thanked for recording the data and collection of the samples and Mr. Tony Blake for making the sheep available.

R. S. Whitley
June 1979

Circulation: All farms and interested bodies
OIM
N. Knight

TABLE 1

Summary of details of ewes which were slaughtered at North Arm between April and August 1978

	Ewes born 1975 (maidens)	Ewes born 1974 (1-crop)	Ewes born 1973 (2-crop)
Number involved	58	55	50
Mean weight at start kg ± 1SD	33.6 ± 5.8	40.2 ± 7.3	40.6 ± 4.6
Mean carcase weight (1) kg ± 1SD	16.0 ± 2.2	18.7 ± 3.1	18.9 ± 2.3
Mean killing out percentage (3) % ± 1SD	43.3 ± 3.3	44.8 ± 2.9	44.1 ± 3.3
Mean chest depth (2) cm ± 1SD	26.4 ± 1.2	28.0 ± 1.9	28.5 ± 1.5
Number which got in lamb by mistake	7	10	16
Percentage of ewes available	10.8%	15.4%	24.2%

(1) Carcase weight was measured as dressed carcase with head and kidneys.

(2) Chest depth was measured at greatest value on live animal.

(3) Killing out percentage calculated from $\frac{\text{Carcase weight}}{\text{Body weight prior to slaughter}} \times 100$

TABLE 2

Mean body weights, standard deviation and coefficient of variation of 16 ewes in each of 3 different age groups at North Arm from April to August 1978

DATE		1.4	10.4	17.4	24.4	1.5	8.5	15.5	22.5	29.5	5.6	12.6
Ewes born 1973 entering 3rd breeding season	Mean body weight kgs	44.7	44.8	47.2	45.2	48.0	47.3	47.3	48.1	47.0	46.5	46.9
	Standard deviation kgs	4.9	4.5	4.6	4.4	4.8	4.5	4.8	4.3	4.7	4.4	4.4
	Coefficient of variation %	11	10	10	10	10	10	10	9	10	10	9
Ewes born 1974 entering 2nd breeding season	Mean body weight kgs	43.4	45.1	46.7	44.3	47.2	46.2	46.9	47.1	46.5	46.2	46.5
	Standard deviation kgs	4.2	4.6	3.3	3.7	3.3	3.5	3.4	3.1	3.7	3.4	3.5
	Coefficient of variation %	10	10	8	8	7	7	7	7	8	7	8
Ewes born 1975 entering 1st breeding season	Mean body weight kgs	36.8	38.7	40.0	38.3	41.0	40.3	40.8	41.2	40.7	40.2	39.9
	Standard deviation kgs	3.0	4.0	3.4	3.0	3.1	3.3	2.9	2.9	2.7	2.7	2.8
	Coefficient of variation %	8	10	9	9	8	8	7	7	7	7	7

CONTINUED BELOW

CONTINUED FROM ABOVE

DATE		19.6	26.6	3.7	10.7	17.7	24.7	31.7	7.8	14.8	21.8
Ewes born 1973 entering 3rd breeding season	Mean body weight kgs	47.0	47.3	47.1	47.8	44.8	42.9	42.5	41.3	40.8	40.1
	Standard deviation kgs	4.3	4.1	4.7	4.4	4.3	4.3	4.2	4.4	4.1	4.0
	Coefficient of variation %	9	9	10	9	10	10	10	11	10	10
Ewes born 1974 entering 2nd breeding season	Mean body weight kgs	46.4	46.5	46.5	47.4	44.0	42.0	41.6	40.7	39.6	38.3
	Standard deviation kgs	3.6	3.4	3.9	3.9	3.9	3.4	3.9	4.3	3.9	3.5
	Coefficient of variation %	8	7	8	8	9	8	9	10	10	9
Ewes born 1975 entering 1st breeding season	Mean body weight kgs	40.4	41.2	40.7	41.9	38.3	36.5	36.9	34.6	34.9	34.5
	Standard deviation kgs	2.7	2.8	2.2	2.4	1.9	2.6	2.5	2.0	2.1	1.9
	Coefficient of variation %	7	7	5	6	5	7	7	6	6	6

TABLE [illegible]

Details of weekly totals of Corpora Lutea and sheep present with the percentage of Corpora Lutea per ewe and numbers of sheep in anoestrus

CONTINUED BELOW

	DATE	10.4	17.4	24.4	1.5	8.5	15.5	22.5	29.5	5.6	12.6
	WEIGHT NO	2	3	4	5	6	7	8	9	10	11
CORPORA LUTEA PRESENT	2-CROP	1	3	3	3	3	7	3	3	3	3
	1-CROP	4	4	4	2	4	4	4	5	3	3
	0-CROP	3	2	3	4	3	4	4	5	3	3
	TOTAL	8	9	10	9	10	15	11	13	9	9
SHEEP RELEVANT	2-CROP	3	3	4	3	3	4	3	3	3	3
	1-CROP	3	4	3	2	4	3	3	4	3	3
	0-CROP	4	3	3	4	3	3	4	3	3	4
	TOTAL	10	10	10	9	10	10	10	10	9	10
PERCENTAGE CL PER EWE	2-CROP	33	100	75	100	100	175	100	100	100	100
	1-CROP	133	100	133	100	100	133	133	125	100	100
	0-CROP	75	66	100	100	100	133	100	166	100	75
	TOTAL	80	90	100	100	100	150	110	130	100	90

CONTINUED FROM ABOVE

	DATE	19.6	26.6	3.7	10.7	17.7	24.7	31.7	7.8	14.8	21.8
	WEIGHT NO	12	13	14	15	16	17	18	19	20	21
CORPORA LUTEA PRESENT	2-CROP	3	3	2	2	3	1	1	0	0	1
	1-CROP	3	2	1	3	2	3	4	0	1	1
	0-CROP	1	3	3	2	0	4	2	2	1	0
	TOTAL	7	8	6	7	5	8	7	2	2	2
SHEEP RELEVANT	2-CROP	3	3	2	2	2	1	1	1	2	3
	1-CROP	3	2	1	3	3	3	4	0	3	2
	0-CROP	2	2	3	2	1	4	3	2	4	1
	TOTAL	8	7	6	7	6	8	8	3	9	6
PERCENTAGE CL PER EWE	2-CROP	100	100	100	100	150	100	100	0	0	33
	1-CROP	100	100	100	100	66	100	100	0	33	50
	0-CROP	50	150	100	100	0	100	66	100	25	0
	TOTAL	88	114	100	100	83	100	88	66	22	33
SHEEP CONSIDERED IN ANOESTRUS	2-CROP								1	1	2
	1-CROP					1				2	1
	0-CROP					1		1		3	1
	TOTAL					2	0	1	1	6	4

FIGURE 1 MEAN BODY WEIGHTS OF 16 EWES IN EACH OF 3 AGE GROUPS FROM APRIL TO AUGUST [illegible] AT NORTH HILL

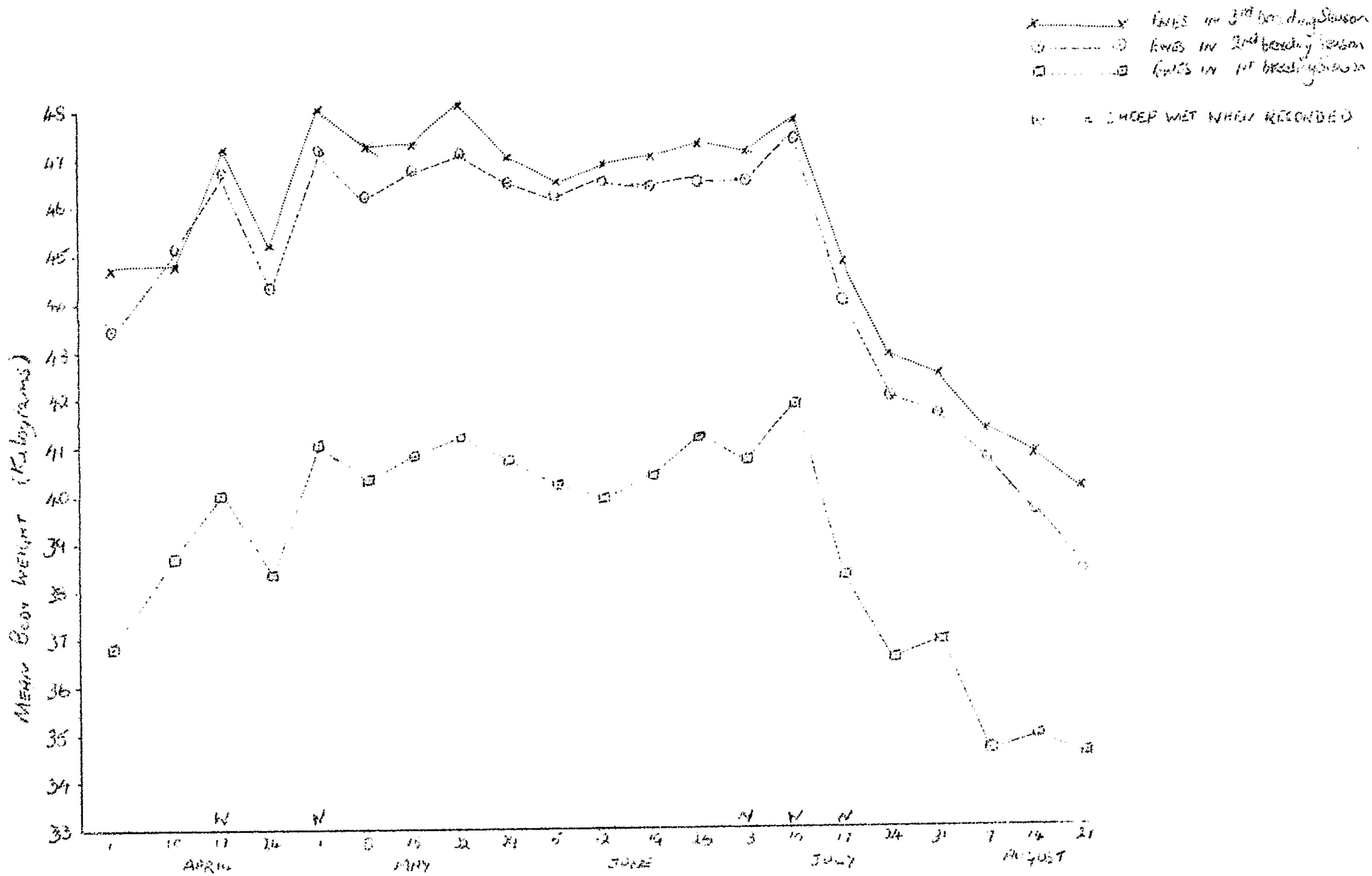
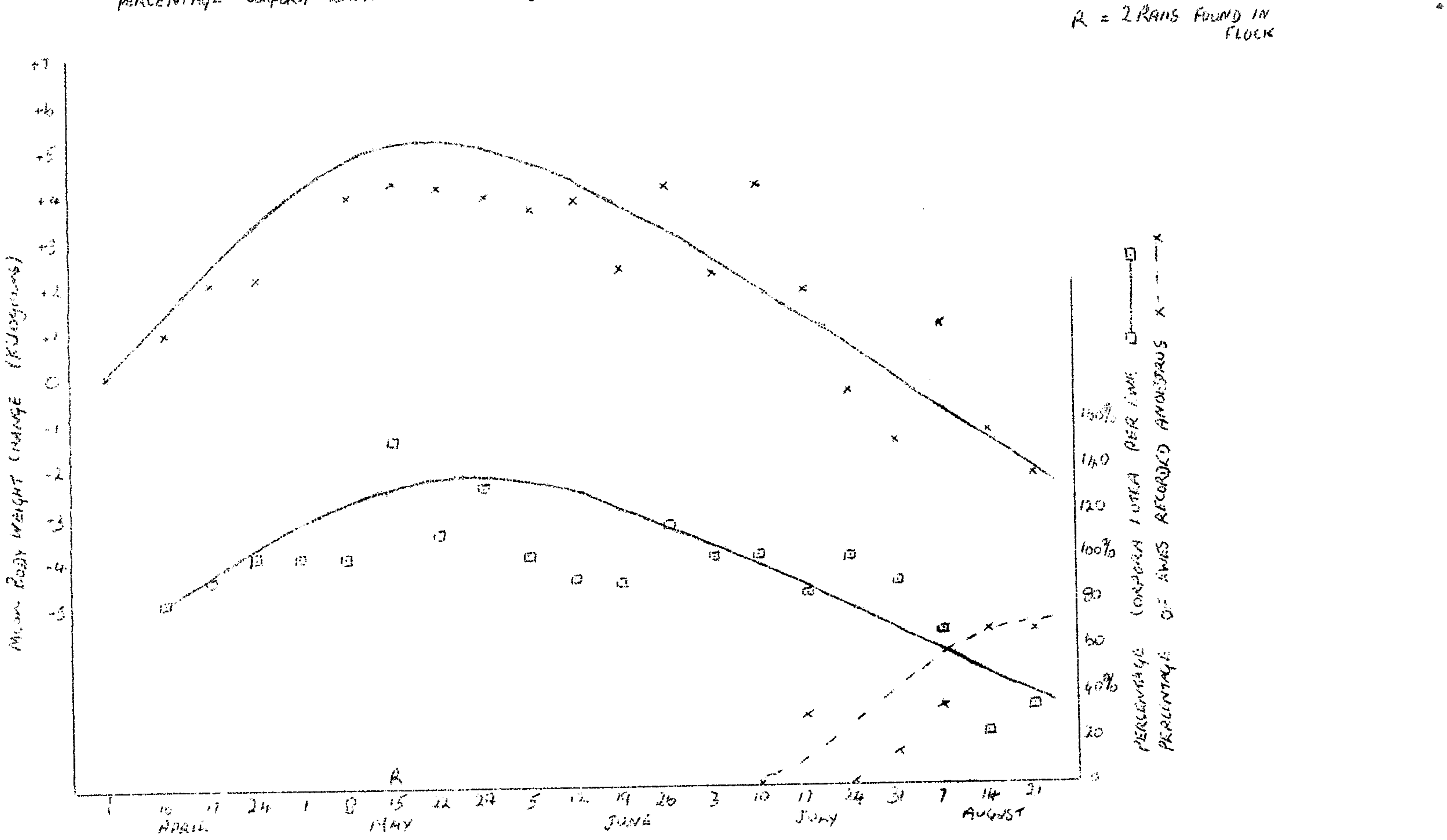


FIGURE 2

MEAN BODY WEIGHT CHANGE OF EWES SLAUGHTERED EACH WEEK FROM APRIL TO AUGUST, THE PERCENTAGE CORPORA LUTEA PER EWE AND PERCENTAGE EWES RECORDED IN ANOESTRUS.



AP. 3.5 C

REPORT ON THE INFORMATION COLLECTED AT HILL COVE 1978/79 CONCERNING PERINATAL MORTALITY AND LAMB PERFORMANCE.

Summary: In two flocks of ewes (Mount Edgeworth, 2- and 3- crop, and Main Point 1- crop) the apparent lambing percentages were 82% and 84% respectively but the apparent lamb losses were 12% and 25% respectively.

Although the birth weights of lambs in Crooked Inlet West (3.3 Kg) which were born in mid October were lighter than the lambs born in Holmsteds (3.8 Kg) in November, the difference had disappeared by weaning when the average body weight of 252 lambs was 19.1 Kg.

The method of recording is briefly described and the problems and inaccuracies discussed. Lines of further investigation are suggested.

Introduction: In September 1978 nine farms were asked to participate in a small pilot survey to obtain information on ewe barrenness, perinatal mortality of lambs, lamb birth, marking and weaning weights.

The information received from Hill Cove is presented below.

Ewe Barrenness and perinatal mortality of lambs. In each of two flocks, Mount Edgeworth and Main Point, 100 ewes were examined approximately one month before the onset of lambing. Those ewes which were thought to be in lamb were raddle marked with one colour and those thought not to be in lamb were marked with another colour.

At lamb marking, these ewes were again examined and the state of the udder recorded as being "milk" or "dry". It was considered that "milk" ewes had produced a lamb which had effectively suckled for some time and those that were "dry" had either not produced (i.e. were barren) a lamb or had given birth to a lamb that had not suckled effectively and had died.

Unfortunately it was not possible to follow the progress of the ewes through to weaning but the details of the recorded information are set out below:-

Mount Edgeworth flock of ewes having their second and third lambs ($3\frac{3}{4}$ and $4\frac{3}{4}$ years old respectively).

Random sample of 100 ewes examined one month prior to lambing:-

64 in lamb and 36 not in lamb.

at marking:- of the 64 thought to be in lamb, 60 were "milk" and 4 "dry".

of the 36 thought not to be in lamb, 22 were "milk" and 14 "dry".

Therefore a total of 82 were "milk" compared to a recorded lamb marking percentage of 69.4% (on ewes present) indicating a loss of about 12% between birth and marking.

The apparent lambing percentage was 82%.

Main Point flock of 100 maiden ewes:-

of the 64 thought to be in lamb and the 36 thought not to be in lamb when examined one month prior to lambing, 60 and 24 respectively had milked and 4 and 12 respectively were dry.

The lamb marking tally was 58.8% which shows an approximate loss of 25% (60 + 24 = 84 - 59 = 25) between birth and marking.

The assumed lambing percentage being 84%.

Lamb Birth Weights

Crooked Inlet West The onset of lambing in this flock of mixed age ewes was in the middle of October and the lamb birth weights recorded in the first 24 hours of life between 13th and 23rd October 1978 were as follows:- (lamb's sex was not recorded).

ewe age	number	lamb weight (± 1SD)
5 crop	21	3.4 ± 0.7 Kg
4 crop	1	3.0 Kg
3 crop	12	3.1 ± 0.6 Kg
2 crop	2	4.3 ± 0.3 Kg
1 crop	1	3.8 Kg
0 crop	7	2.7 ± 1.4 Kg
Total	44	3.3 ± 0.8 Kg

The average weight of lamb per ewe from 41 ewes (i.e. three sets of twins) was 3.5 ± 1.0 Kg

Holmsteds The onset of lambing in this flock of mixed age ewes was at the very end of October and the lamb birth weights were recorded between 30th October and 12th November.

ewe age	number	lamb weight (± 1SD)
2	4	4.0 ± 0.6 Kg
4	19	3.8 ± 0.7 Kg
5	1	4.0 Kg
Total	24	3.8 ± 0.6 Kg

If the period 30th October to 12th November is approximately equally divided, the birth weights of the lambs were as follows:-

14 lambs born between 30th October and 4th November = 3.8 ± 0.7 Kg
10 lambs born between 5th November and 12th November = 3.8 ± 0.5 Kg

The Average Weight of lamb per ewe (including two sets of twins) was 4.2 ± 1.1 Kg.

The Average Weight of 11 male lambs was 3.9 ± 0.6 Kg
The Average Weight of 13 female lambs was 3.8 ± 0.7 Kg

Lamb weaning weights In February 1979 a random cut of lambs from each of three flocks were taken and weighed immediately after gathering except in the case of the West Lagoons lambs which were weighed two days later.

Units (where applicable) expressed in Kg ± 1SD

Flock		Ewe	Wether	Total
Holmsteds 13.2.79	Number	45	56	101
	Weight	19.2 ± 2.9	19.6 ± 2.9	19.4 Kg
West Lagoons 15.2.79	Number	42	37	79
	Weight	18.1 ± 3.3	18.2 ± 3.9	18.1 Kg
Crooked Inlet West 16.2.79	Number	38	34	72
	Weight	19.6 ± 3.4	20.3 ± 3.0	19.9 Kg
TOTAL	Number	125	127	252
	Weight	19.0 Kg	19.4 Kg	19.1 Kg

Discussion. All the information presented here has been gleaned by the farm staff and, because of some uncertainties about the recording procedures, none has been subjected to statistical analysis. However, the nature of the investigation was that of a pilot and no aspertions should be cast on the value of the information collected - information which has been entirely lacking until now.

The most salient features of the ewe barrenness and perinatal mortality were:-

(1) The inaccuracy of examination of the ewes one month before the onset of lambing was biased towards the so-called "dry" ewes, at least 22 out of 36 and 12 out of 24 did, in fact have lambs which were suckled. Shepherds' observations have been that, in normal years, lambing is always slow to start and builds up to a peak in the second and third weeks after the onset. Therefore by examination at one month prior to the onset most of the ewes will be at least 6 - 7 weeks from lambing (i.e. 42 - 49 days) and many will be more than this, hence the difficulties of examination leading to the inaccuracies outlined above.

(2) 82% of the 2- and 3- crop ewes had lambs but 12% of those lambs died before marking whereas 25% of the lambs born to maiden ewes died in a similar period, their lambing percentage being 84%. From the lamb birth weights at Crooked Inlet West (Hill Cove) it is seen that these maiden ewes produced lighter lambs than older age groups. This is in accordance with the findings at Salvador where 1, 2 crop ewes produced lambs of 3.8 Kg and 3, 4, 5, 6 crop ewes averaged 4.2 Kg per lamb. The less good mothering instincts of maiden ewes combined with the lower birth weights of their lambs probably accounts for this very high loss of lambs born.

It should be noted that most of the figures are not precise but should be regarded as approximations.

The unknown factors involved in the accumulation of lamb birth weight information under the very extensive and difficult field conditions of the Falkland Islands should not depreciate the value of the information collected. Although the lambs were all weighed when less than 24 hours old, it is not known whether or not they had suckled and nothing is known of the ewes' physical state. However, it seems probable that there is a difference between the two flocks (3.3 Kg and 3.5 Kg) but whether this is due to a difference in lambing date or some other factor(s) is impossible to say. Any difference had disappeared by weaning (although the same lambs were not recorded).

The mean lamb birth weight for both flocks was 3.5 Kg (68 lambs) which compares with 4.0 Kg from 317 lambs at Salvador (in the FYRGS Trace Element Trial 1977/78 Study). The average weaning weight of wether lambs was slightly greater than that of ewe lambs in all three recorded flocks and the grand mean of 19.1 Kg (from 252) compares with 19.9 Kg at North Arm (100 wether lambs) and, at Salvador, 17.9 Kg (100 ewe lambs, Ronda flock) and 22.5 Kg and 23.6 Kg (50 ewe and 50 wether lambs respectively, Limpet Creek flock).

As mentioned above, any difference in birth weights between the early (Crooked Inlet West) and later (Holmsteds) born lambs had disappeared by weaning - 19.9 Kg (from 72) compared to 19.4 Kg (from 101) respectively.

Conclusion: A more accurate method of pregnancy assessment is required possibly using the Sonicaid ultrasonic fetometer but until that becomes possible it is necessary to repeat this year's recordings to obtain further information.

Such information is required on the different pregnancy rates according to age and the subsequent lamb losses.

It is hoped that the recording of lamb birth weights and weaning weights will be repeated and augmented by marking weights.

It is most gratifying to have the information presented so far and we are now beginning to find out a little about the Falkland Island Sheep.

Acknowledgements and thanks are due to Mr. L. G. Blake, Mr. T. Aldridge and all others who assisted in the collection of these data.

R. S. Whitley M.R.C.V.S.
19th March 1979

AP 3.5 D

REPORT INTO AN INVESTIGATION INTO EWE BARRENNESS AND PERINATAL MORTALITY IN LAMBS BORN FROM MAIDEN EWES AT PORT STEPHENS. 1977/78/79

Summary

In 1978, a group of maiden ewes were examined for evidence of success in rearing a lamb. It was found that 44% were unsuccessful. A year later at their second lambing 61% of the remaining ewes were unsuccessful and 21% were "barren" on both occasions.

In 1979 a further sample of maiden ewes were examined approximately two weeks prior to the onset of lambing and a group of pregnant ewes identified. At weaning 15% were found to have lost their lambs at, or very soon after, birth.

Comparison between the two years was difficult because of a change in management practice.

Further lines of investigation are suggested.

Introduction

At Port Stephens - a farm which has consistantly low lamb weaning percentages but which has subsequent low losses to shearing - the maiden ewes have, for some years, been shorn two weeks to one month before the onset of lambing. Apart from one year when there was an enforced delay in shearing which coincided with very poor weather conditions resulting in high losses of ewes and lambs, the exercise is probably a success in that more lambs are reared to weaning and the ewe loss is reduced.

The fact that these ewes have to be handled near to lambing has been utilised in such a way, as described below, to gain information about barrenness and perinatal mortality.

Methods.

In the period 1977/79 as part of an investigation into the effects of cobalt supplementation to maiden ewes, a group of 200 ewes were randomly selected at prelamb shearing (Group 1). These maiden ewes were run with their normal flock and examined at weaning. Although for the purposes of the cobalt investigation, body weights were recorded, data presented here are limited to those recorded from examination of the ewes' udders and classification as those that had milked and those that had not.

In 1979 these same ewes (or the remainder of them) were again examined after their second pregnancy and a similar classification made.

Also in 1979, a further group of maiden ewes was identified by ear tagging at shearing in November. These ewes were specifically selected for evidence of their being in lamb (by abdominal palpation and udder enlargement). Again they were run with the rest of the flock and examined at weaning time (identical to lambmarking on this farm). Results of the udder examination are presented below

Results

Group 1 (disregarding any effects of the cobalt treatment).

In 1977/78

200 examined prelambing (3.11.77)
173 examined at weaning (23.3.78) of which

96 (56%) had lambed and successfully milked (but not necessarily all the time to weaning) and

77 (44%) had either not lambed or had lost their lambs very soon after birth.

The flock lamb weaning percentage was 38.5%

In 1978/79

114 of the ewes remained for examination of which

53 (47%) were judged to have lambed and

61 (53%) had either not lambed or had lost their lambs very soon after birth.

Group 2

In 1978/79

of 100 ewes which were "definitely" in lamb at shearing on 3.11.78, when examined at weaning on 15.3.79,

93 ewes were examined and of these

79 (85%) had had lambs and suckled them and

14 (15%) had not been suckled (sufficiently to still have a visible or palpable effect).

The flock with which Group 2 was run suffered ewe losses of 2.2% from May to shearing in November and 3.1% from then until weaning and produced a lamb weaning percentage of 58.1% compared with the average for the farm of 57.5%.

Of the two groups of maiden ewes examined at weaning, the number of ewes which were judged to have lambed and successfully milked was subdivided into two groups as shown:-

	1977/78	1978/79
Total examined at weaning:	173	93
Total still with fluid in udders:	96	79
Those still being suckled:	65 (68%)	76 (96%)
Those drying off:	31 (32%)	3 (4%)

(figures in brackets are the percentages of the total with fluid in their udders when examined at weaning).

Comparison of the two years in which Group 1 have been recorded produced the following table:-

Ewes recorded in both years	111
Ewes which lambed at least once	88
Ewes which lambed in both years	33
Ewes which lambed in neither year	23
Ewes which lambed in the 1st year but not in the second	37
Ewes which lambed in the 2nd year but not the first	18

(In this context the word "lambed" is taken to mean a ewe which has been suckled by a lamb so that she still has a significant amount of fluid when examined at weaning. The converse of lambed, used here, is "barren").

Discussion

Port Stephens, a farm of 250,000 acres carrying 30,000 sheep, is cobalt deficient land, the effects of which are counteracted by administration of a cobalt bullet (Permaco-S T.V.L.) to all lambs at weaning. Although it is possible that other minor elements are absent from the sheeps' diet and which may affect reproductive performance, the investigation outlined here is purely descriptive.

Examination of the specially selected Group 2 shows that 15% of the lambs were lost before they had effectively suckled and a further 4% ceased suckling before being weaned (either due to death of the lamb, mismothering or the ewe drying off).

It is apparent that the two years 1977/78 and 1978/79 produced very different results from the flock (38.5% and 58.1% lamb weaning percentages respectively), and although the latter year was very dry in the summer and the onset of grass growth in the spring having a few "false starts", the main difference is probably due to a change of pasture for the lactation period.

In previous years (such as 1977/78) the ewes lambed in Cow Valley camp and, at weaning, the lambs tended to be very variable in size and condition and many of the ewes were in poor condition. In 1978/79 Cape Orford camp was used for the lactational period and the (assumed) better nutrition there is shown by the comparison of the percentage of ewes which are known to have lambed but are now drying off:-

1977/78	32%
1978/79	4%

(Although this comparison is not strictly valid, because the 1978/79 ewes were specially selected, it does give an indication of the difference).

Because of the change in management practice further direct comparison between the years would be misleading, nevertheless it is apparent that in both years there must be a significant proportion of the ewes which totally failed to lamb at all. In 1977/78 44% were, to all intents and purposes, barren. In 1978/79, if 82% of the ewes examined had been suckled by a lamb and most (96%) were still being suckled by a lamb, but the flock lambing percentage was only 58.1% then there must be quite a sizeable proportion of the flock which is totally barren.

The recording of Group 1 over a period of two years showed that 23 out of 111 (21%) ewes were barren on both occasions.

The fact that 33% lambed as maiden ewes but not in their second crop and 16% were the reverse of this, is contrary to what was expected and requires further investigation. Apart from the maiden ewes, all ewes are run in flocks of mixed ages and so further information cannot be gleaned from flock figures.

Conclusion

It is apparent that a significant proportion of the ewes do not produce a lamb which suckles effectively. It indicates that further investigation is required to determine the percentage of ewes in lamb at the onset of lambing and so points out more closely the point at which this loss of production occurs. The fact that the ewes are brought in for shearing presents a good opportunity for detailed examination using the Sonicaid fetometer. It is hoped to do this next season.

Setting aside the reversal of the expected figures for these ewes in Group 1 which were examined twice but lambed only once, (a fact which requires more detailed study) the figure of 21% of ewes which were "barren" on both occasions indicates that further investigation is required and, if it is a true figure, the possible instigation of a ruthless culling programme.

Acknowledgements

The collection of much of these details was done by farm staff whose general enthusiasm and interest made the project easier. It is hoped that the mutual stimulation thus derived will lead to a greater understanding of the flock problems of Falkland Islands sheep.

R. S. Whitley
27th March 1979

AP 3.5 D

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Ewes which lambed in both years	33
Ewes which lambed in neither year	23
Ewes which lambed in the 1st year but not in the second	37
Ewes which lambed in the 2nd year but not the first	18

(In this context the word "lambed" is taken to mean a ewe which has been suckled by a lamb so that she still has a significant amount of fluid when examined at weaning. The converse of lambed, used here, is "barren").

Discussion

Port Stephens, a farm of 250,000 acres carrying 30,000 sheep, is cobalt deficient land, the effects of which are counteracted by administration of a cobalt bullet (Permaco-S T.V.L.) to all lambs at weaning. Although it is possible that other minor elements are absent from the sheeps' diet and which may affect reproductive performance, the investigation outlined here is purely descriptive.

Examination of the specially selected Group 2 shows that 15% of the lambs were lost before they had effectively suckled and a further 4% ceased suckling before being weaned (either due to death of the lamb, mismothering or the ewe drying off).

It is apparent that the two years 1977/78 and 1978/79 produced very different results from the flock (38.5% and 58.1% lamb weaning percentages respectively), and although the latter year was very dry in the summer and the onset of grass growth in the spring having a few "false starts", the main difference is probably due to a change of pasture for the lactation period.

In previous years (such as 1977/78) the ewes lambed in Cow Valley camp and, at weaning, the lambs tended to be very variable in size and condition and many of the ewes were in poor condition. In 1978/79 Cape Orford camp was used for the lactational period and the (assumed) better nutrition there is shown by the comparison of the percentage of ewes which are known to have lambed but are now drying off:-

1977/78	32%
1978/79	4%

(Although this comparison is not strictly valid, because the 1978/79 ewes were specially selected, it does give an indication of the difference).

Because of the change in management practice further direct comparison between the years would be misleading, nevertheless it is apparent that in both years there must be a significant proportion of the ewes which totally failed to lamb at all. In 1977/78 44% were, to all intents and purposes, barren. In 1978/79, if 82% of the ewes examined had been suckled by a lamb and most (96%) were still being suckled by a lamb, but the flock lambing percentage was only 58.1% then there must be quite a sizeable proportion of the flock which is totally barren.

The recording of Group 1 over a period of two years showed that 23 out of 111 (21%) ewes were barren on both occasions.

The fact that 33% lambed as maiden ewes but not in their second crop and 16% were the reverse of this, is contrary to what was expected and requires further investigation. Apart from the maiden ewes, all ewes are run in flocks of mixed ages and so further information cannot be gleaned from flock figures.

Conclusion

It is apparent that a significant proportion of the ewes do not produce a lamb which suckles effectively. It indicates that further investigation is required to determine the percentage of ewes in lamb at the onset of lambing and so points out more closely the point at which this loss of production occurs. The fact that the ewes are brought in for shearing presents a good opportunity for detailed examination using the Sonicaid fetometer. It is hoped to do this next season.

Setting aside the reversal of the expected figures for these ewes in Group 1 which were examined twice but lambed only once, (a fact which requires more detailed study) the figure of 21% of ewes which were "barren" on both occasions indicates that further investigation is required and, if it is a true figure, the possible instigation of a ruthless culling programme.

Acknowledgements

The collection of much of these details was done by farm staff whose general enthusiasm and interest made the project easier. It is hoped that the mutual stimulation thus derived will lead to a greater understanding of the flock problems of Falkland Islands sheep.

R. S. Whitley
27th March 1979

Investigation into barrenness and perinatal mortality at Pebble Island 1978-79

Introduction: One of the most serious gaps in the knowledge of breeding success of Falkland Island sheep is that it is not known what proportion of ewes do produce lambs even though many of these lambs may be lost before marking. The significance of this information is not restricted to the ewe's reproductive success but also to that of the rams in covering the ewes in a very extensive environment.

Present day trends are towards total isolation of the ewes at lambing time - hence selecting very heavily towards an "easy-care" sheep - whereas, in the past when the ewes were shepherded, some indication of percentage of ewes lambing was available from the shepherds, but this was still only an indication.

This investigation on Pebble Island was organised to obtain information on perinatal mortality without involvement in lamb birth recording, on barrenness, and on ram/ewe reproductive success. All recording, selection of animals and field work was performed by farm staff.

Materials & Methods: A random sample of 200 ewes of mixed ages was separated from the rest of the "Big Flock" (2434 ewes) on 3rd October - lambing being due to commence on 16th October. Examination of the abdomen and udders of these sheep lead to the conclusion that 175 were in lamb and 25 were thought not to be in lamb. Ewes in each of these two groups were given different coloured ear tags for later identification at lamb marking and weaning times (Dec 12th and Feb 2nd respectively).

Examination at these times resulted in the ewes being classified as either "reared lamb", "part reared lamb" (i.e. she gave birth to a lamb which suckled but had since died. This was judged by the condition and contents of the udders), or "barren" (even though she may have given birth to a lamb which never suckled).

The results are laid out below:-

	Prior to Lambing	Marking	Weaning
200 ewes	175 in lamb	140 reared lambs 18 part reared lambs 8 barren	131 reared lambs 18 part reared 6 barren
	25 not in lamb	14 reared lambs 3 part reared lambs 14 barren	14 reared lambs 1 part reared 8 barren
Totals:	200	197	178
Ewe loss (%)		1.5%	9.6%

Lambs marked:		
	ewes	89
	wethers	72
	rigs	1
		162 = 81% of ewes at lambing

Discussion: This island farm normally has a higher lamb marking figure than many mainland farms, and in this group of 200 ewes, the 81% is reflective of the flock percentage.

In an attempt to decrease the (presumed) early embryonic mortality caused by stress at the time of ram lifting, the manager for the first time, left his rams with the ewes for longer than the traditional 6 weeks. This would tend to lead to a prolonged lambing and greater difficulty in examination of some ewes prior to the onset of lambing.

Of the 197 ewes remaining at lamb marking time, 175 had lambed but 17 of these were originally thought to be barren. This indicates the inherant inaccuracy in this method of separation of pregnant from non-pregnant ewes even when the examination is performed by experienced stockmen.

Coverage of the ewes by rams is indicated by the 175 ewes out of 197 (89%) which are thought to have produced a lamb (by udder examination). This does not allow for those ewes which, although pregnant, did not successfully produce any milk, but even so, the figure is lower than expected.

It is interesting to note that the greatest losses between marking and weaning occurred in the ewes thought to be barren (36%) compared to 6% in the ewes which reared lambs.

A further inaccuracy in this method is shown by the fact that the lamb marking percentage of 81% was 8% less than the calculated birth percentage of 89%. This is to be compared with 12% of the ewes which had produced a lamb failing to rear it to marking time. The discrepancy presumably is because some of the lambs survived even though they ceased suckling their mothers.

Conclusion: Although it provides information about the reproductive success of ewes in a cheap and relatively simple way which could easily be performed by farm staff, the method is not accurate enough for reliable conclusions to be drawn concerning perinatal mortality and ewe barrenness in a flock situation.

Acknowledgements: I am indebted Mr. G. O. Evans and his staff who performed all the selection, recording and field work.

R. S. Whitley M.R.C.V.S.
8th March 1979

AP. 3.6 A

SOME NOTES ON FACTORS CONCERNED IN THE FORMULATION OF A BREEDING PLAN FOR SHEEP FLOCKS

R. S. WHITLEY M.R.C.V.S.

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Introduction

Since the earliest times man has castrated animals which thus enabled him to keep fewer entire males in his flocks and herds and so increase the degree of selection for characters he was trying to improve.

Although the Romans and Greeks were very interested in animal improvements, the subject went into a decline during the Dark Ages and it wasn't until the 18th Century that refinements were made to methods used in sheep breeding. These laid the foundation for modern practice and were developed in Britain by Robert Bakewell who developed the Dishley breed which later became known as the English Leicester.

Intense interest was thus aroused and breeders became involved in many different methods for trying to improve sheep strains basically aimed at the meat market and secondarily at the wool market - the latter being stimulated by imports of breeds from Europe during the Peninsular War.

Various theories concerning the breeding of sheep were developed in subsequent years including "The Doctrine of Constancy of the Breed" ("the certainty or uncertainty in the inheritance of characters by an animal depends on whether their decent is pure or not"), which attached great importance to the knowledge of Pedigree; The Theory of Potency (some sires were more "potent" than others because their progeny better showed some of the sire's desirable characters); and the theory that indigenous breeds were more satisfactory because they were adapted to local conditions (while this may be true for characters affecting the survival fitness of animals, it ignores the possibility that improved breeds may be more productive when natural constraints are removed).

The monk Gregor Mendel postulated that in biological systems some characters were controlled by directly related factors which occurred in pairs, one of each pair from one parent being matched by one of a similar pair in another parent but that some factors, although they may be carried by an animal or plant, are not actually revealed (i.e. one factor is "dominant" to another). However, in animal production, Mendelian genetics is limited to the few characters which were found segregating in different breeds (i.e. coat colour, horned or polled characters). In most instances of characters concerned with animal production, the many factors are often interrelated and so there are intermediate levels instead of such sharply defined characteristics as black and white wool. And so it was shown that one cannot expect rapid improvement in (say) fleece weight by introducing a single major gene (factor) because of its complex interrelation with other factors.

The aim of animal breeders has always been to produce superior animals by manipulating the inherent qualities of the stock. Most breeding animals have been chosen on their own appearance while there was no precise information about the relative merits of pedigrees, progeny or other relatives. The Breed Societies have been concerned with protection of the purity of the breed with emphasis varying between type, show points and productivity (with concurrent development of uniformity).

Thus modern genetics (and hence breeding programmes) are based on two principles: firstly, that the appearance is not always a reliable guide to its value as a breeding animal (this depends on the inherited characters and the effect of environment on development); and secondly, that modern applied genetics has placed emphasis on breeding only for those characters that are important for commercial production. When looks (type) are rated then it is necessary to discard some animals which are good producers.

These factors have led to arguments between applied geneticists and stud owners to whom type ratings and show success have (considerable) monetary value.

Manufacturing processes demand a certain combination of characters in wool and the nearer that a producer is able to approach that ideal, the higher the price is paid for his wool. However, with the wide range of manufacturing demands that exists, it is necessary for the producer to define his aims in terms of wool type considering the environmental effects on the wool production and the market on which his wool is sold. When there are few purchasers the producers must be aware of the commercial factors which control the price paid for wool.

The weight of a wool sample, its crimp number per inch, the length and colour are the most important economic traits for raw wool at the moment, but processing demands are leading to increased attention to fibre diameter and this, therefore, should replace usually assessed crimp number as the selection criterion, as well as the factor on which prices are based. Visual classing of sheep produces a greater increase in value per head than in weight per head but is not as efficient in raising value as selection or management. The cost of fleece weighing would beed to be balanced against the gain but little gain can be expected when selection is limited to visual assessment of unmeasured parameters.

In defining production aims, it is necessary to know by how much the selected characters are affected by breeding or by environment and for which of these factors the buyers are prepared to pay (e.g. the "economic weight" for the amount of clean wool weight may be four times that for crimp number).

It is essential to distinguish inheritance from the effects of environment as the latter are not passed on to the offspring and do not contribute to the individual's breeding value. It is pointless to say that Merinos produce heavier fleeces than Bikaneri if the comparison is between the Merinos of New South Wales producing 7kg of wool and the Bikaneri cutting 1½kg in the deserts of Rajasthan.

Heritability estimates the proportion of the parents superiority which will, on average, be demonstrated in her offspring and can be measured by how closely relatives resemble each other when compared with unrelated individuals in the same population. If the heritability is low then the rate of progress by selection will be slow. Individual selection for some fleece quality characters is likely to give rise to a fairly rapid response in genetic improvement, but it should be remembered that a highly heritable character may not necessarily be a commercially desirable one.

Traits, which are moderately highly heritable in Merinos and other allied breeds (taken at 12 months or older), include:- greasy wool weight, percentage clean yield, clean wool yield, body weight, wrinkle score, face cover score, fibre number per unit area, fibre diameter, staple length and number of crimps per inch.

Many characteristics in animals are not independent; for example in Merino flocks, sheep with high wool weight often have a long staple, while animals with a high degree of skin wrinkle tend to produce a short staple. Response to selection for high wool weight in sheep is usually accompanied by a decrease in the number of crimps per unit of staple length. In other words, there may be a positive or negative "correlation" between characteristics, the observed size of which may not be as great as, or it may be greater than, that which is expected because of the interrelation of genetic make up and the environment.

Thus it is apparent that knowledge of the direction and degree of correlation is important in formulation of efficient breeding plans.

The table below listing the extent and direction of correlation between some of the production characteristics is included to show how all these factors are interrelated. (-ve means negative, +ve means positive, Ph = phenotypic correlation and G = genotypic correlation) -

Clean wool weight	has a positive phenotypic (+vePh) and positive genotypic (+veG) correlation with yield, staple length, fibre number per square millimeter, fibre diameter (although the level varies from flock to flock).
" " "	-vePh, -veG with crimps per inch.
" " "	+vePh (variable) with body weight and wrinkle score.

Wrinkle Score	+vePh, +veG with greasy wool weight.
" "	+vePh, but negligible G with clean wool weight.
" "	-vePh, -veG with staple length.
" "	+vePh, +veG with crimps per inch.
Fibre No. per mm^2	-vePh (low), -veG (low) with staple length.
Fibre diameter	-vePh (low), -veG (low) with crimp number.
Crimp number	-vePh, -veG with greasy and clean wool weight yield and staple number.

There are variable (but usually positive) estimates for correlations between numbers of lambs born and weaned and some wool and body characteristics such as body weight.

It is therefore apparent that in selection there must be compromise. For example, the disadvantages of a decrease in the number of crimps per inch must be considered against the more rapid increases in fleece weight. Hence the problem becomes one of relative economic merits of the two courses of action, unless a lower rate of progress is accepted and selection is for the two characters at the same time. (Although there may be a slight concomitant decrease in fibre diameter, the most promising way to increase fleece weight without a change in quality is to increase fibre density).

The economic weight (commercial merit) is usually the relative market value of the trait under consideration or the relative preference of the breeder derived from some other consideration.

Having decided on which characteristics selection is to be based, the extent to which such selection will raise production in the existing flock depends on the repeatability of the production characteristics and their heritability and genetic correlations.

Repeatability, the degree to which a characteristic is likley to recur, measures the extent to which differences between individuals depends on genetic and permanent environmental effects, rather than those which are temporary. In other words, by taking repeated measurements on one individual, one can reduce variations resulting from temporary environmental effects and so assess the repeatability of a characteristic. For example, whilst the repeatability of one lambing record is low - temporary environmental effects (weather, men, dogs etc.) may affect such records - selection accuracy can be increased by taking into account several lambing records. Incidentally, the heritability estimate which is based on one lambing figure is low. The selection for any characteristic should be based on as much information as possible and as is practical.

The total weight of greasy wool on a sheep is composed of various factions:- wax, suint, dirt, vegetable matter and clean wool weight, the latter being proportional to components which may be represented by the formula LANDS where

L = Average length of fibres

A = Average cross-sectional area of fibres

N = Total number of fibres

D = Density (Specific Gravity) of wool

S = Area of skin growing wool

(N ÷ S equals the wool fibre density in the skin)

All the component factors of clean wool weight are highly heritable therefore there is little point in limiting selection to one specific factor at the deliberate expense of others.

Wool quantity, as well as quality, changes with age therefore there are, for ewes, three broad groupings within each of which fleeces will be fairly alike for fibre diameter, length and crimp number:- $2\frac{1}{2}$ - $4\frac{1}{2}$ years, $5\frac{1}{2}$ - $8\frac{1}{2}$ years and $9\frac{1}{2}$ - $10\frac{1}{2}$ years.

Some of the components of clean wool weight are little affected by environmental influences on the adult sheep. For example, the wool follicles are laid down in early life therefore different nutrition does not lead to a change in their numbers. Consequently a change in wool weight due to nutrition is a result of change in fibre volume (i.e. length x cross-sectional area). Whilst maintaining constant crimp number and staple length, selection for increased clean wool weight leads to an increased number of fibres per unit skin area.

A high level of Reproduction rate is required:-

(1) to ensure replacement in a breeding flock of fixed size;

(2) to provide surplus stock, either for sale or to build up numbers (after losses or to take advantage of pasture improvement); and

(3) to ensure as high a selection differential as possible - in a flock of fixed size, a higher reproduction rate means that replacements form a smaller proportion of the total animals available for selection.

For replacement, ewe offspring are the main concern but for surplus stock both sexes are valuable.

When considering sheep reproduction in an extensive environment, it is vital to take into account the concept of the ewe's capacity to rear a lamb with high weaning weight (Mothering Ability) which has several components including the lamb's birth weight and vigour, the lamb's capacity for growth, the ewe's milk production and her mothering instinct. However, it is totally unnecessary to quantify any of these components as the mothering ability and her ability to produce lambs can be measured by weighing and "scoring" her lambs at a certain time after birth (i.e. at weaning).

One problem can arise when culling young animals on visual appraisal alone because there is an unconscious selection against twins, which are generally smaller in early life, in the absence of information about the litter size in which the lambs were born.

Shearing at "12 months" of age includes a range in age of about 40 days which can result in a difference of over threequarters of a pound of greasy wool weight between the youngest and oldest animals (Australian Merinos), as well as an appreciable body weight difference. Therefore selection at as late an age as possible is more satisfactory (i.e. at 15 - 16 months) when more of the variation is due to the interaction of environment and genetic make up rather than due to age.

As stated before, the repeatability of one lambing record is low. Nevertheless lambing records are the key to the success of a particular sheep in the environment in which she is kept. Taken over a period of years (say 3), the repeatability of the total weight of lambs produced and reared to weaning is high and, after all, what is required is not a theoretically successful sheep which looks pretty, but one which has proved herself capable of producing good lambs in that particular environment.

If selection is based on a lamb production index derived from the weight of lambs weaned by the ewes after correction for the number of lambings, it is apparent that selection is considerably biased towards ewes which have twins. Twinning rate responds to selection and is a more efficient method of improving the number of lambs weaned per ewe joined than is a selection against barrenness.

It has been found that there is a positive correlation between body weight, clean wool weight and reproduction rate, although the figure is much higher for the Welsh Mountain sheep than for the Australian Merinos and Scottish Blackface.

Two other body characters have been found to strongly affect the reproduction rate (1) total lamb production (in one trial) was about 20% higher in open faced Corriedale ewes and differences of a similar order were found with Romney ewes. Fleece weights however tended to be higher in sheep with woolly faces, although the differences were small. But as open faced sheep produced more lambs, there is obviously an increase in total wool production from this source. In the Rambouillet breed, it has been found that ewes with open faces produce 11% more lambs and more lbs. of lambs that woolly faced ewes and this was in spite of 3 periodic clippings to prevent wool blindness. So, in this breed at least, the poor lambings cannot only be due to the fact that wool blind ewes have difficulty in seeing their lambs and food.

Secondly; wrinkled sheep had about twice the annual death rate of plain bodied sheep (in one Australian trial). The ewes also produced and reared fewer lambs to weaning and had a poorer constitution.

Sheep can be regarded as machines for turning pastures, or other food, into saleable products. Their efficiency in performing this task is therefore an important characteristic.

A sheep's ability to utilise pasture may depend on 4 factors:-

(1) its ability to walk and seek food;

(2) its ability to seek food of better quality from the acreage available;

(3) its appetite (total food consumption); and

(4) its ability to turn the food it consumes into wool, meat or lambs (efficiency of conversion).

However, if a sheep produces more because it eats more then it may be that the increase in cost of production is greater than the increase in final return. But it has been found that efficiency is always greater than the increase in final return. But it has been found that efficiency is always greater in the higher producing animals regardless of body weight but the efficiency fraction of the wool weight difference increases as the difference in body weight decreases. Thus selection of a breed or strain on wool weight per head would also mean selection of a more efficient one. The wool to food ratio is highest for the Lincoln, than the Polwarth, Corriedale, and lastly the Merino. (Corriedales produce more wool than Polwarths but eat so much more). These considerations are important in view of the changing feed levels which occur under pastoral conditions.

Incidentally, selection based on the weight of wool produced per pound body weight will tend to lower body weight and hence efficiency. What is required for alternating plenty and poverty conditions is not necessarily the sheep which can extract a maximum output for a minimum of input, but rather one that which has the capacity to use the greater amount of food when it is available in times of poverty. A larger appetite, provided that it is combined with above average efficiency of conversion, is an asset.

Thus it can be seen that, although body weight itself has relatively little economic weight, its inclusion as an index always leads to appreciably greater economic gain. This is probably because of the higher efficiency and the high heritability of body weight and its positive correlations with important traits such as wool weight and fertility. (There is some difference of opinion concerning this statement but the general concensus supports it.)

Because the proportion saved is much lower for rams than ewes, the selection differential is correspondingly higher, so that ram selection will, per capita, contribute more to genetic gains than ewe selection. However, the success of ram selection depends entirely on the genetic potential carried by the ram which he inherited from his parents. In other words we have a "chicken and egg" situation which can only be resolved by defining the limits of our assessment methods and the time taken for such assessment to occur. It is therefore a mistake to assume that ewe selection is of no importance at all; the contribution of ewe selection to genetic gain depends on the level of culling which is possible, and this in turn is related to the flock structure and reproduction rate (i.e. what proportion of the lambs are required for replacement and this depends totally on the success of ewes in producing and rearing lambs in their local environment and under that particular system of management).

Genetic progress depends on the intensity of selection applied to the parents and the extent to which the gains made by selection are passed on to the offspring (which depends on the heritability of the factor).

The prime concern of the sheep farmer, having an appreciation of the problems of heritability, correlation and efficiency, and particularly the farmer operating in an extensive environment, is to make use, by selection, of the wide range of genetic potential already available and functioning in his special environment and not by attempting to impose new genetic material which is unproven in that set of conditions.

There is a variety of selection methods and their suitability depends on the farming practice and the interrelationship of the factors being selected. Theoretical methods are of little concern where practical realities of the farming operation are involved.

One system (which is often practised by farmers, in any case) is the system of Independent Culling Levels:- at any one time an animal is culled when its measurement of a trait is below a certain standard, regardless of its merits in others. In other words, the individuals of a flock are first culled for character A until a certain level is reached, the remainder are then culled for point B to a certain level and the remainder for point C etc. This system is easy to apply and can be used in conjunction with quantitative information about fleece characteristics. The choice of characters represented by A, B and C etc. depend on the farmer's preference (economic merit) for the various points.

A second selection method which is sometimes used is that of Tandem Selection where selection is based on one character (such as wool weight) for a certain time and then is followed by corrective selection (e.g. for crimp number) for another period of time. This method, although it may lead to more rapid rates of genetic progress, is fraught with difficulties and is limited in the number of characters for which it can apply.

It is obviously an advantage to make the selection as early as **possible in the animal's life so that the increased production in the** current flock then operates for as long as possible, while future (improved) generations replace the existing one more rapidly when animals are mated at an earlier age, for example, with rams it is possible to get more rapid rates of genetic progress if the generation interval is short (i.e. may be as little as 2 seasons but this depends on the reproduction rate of the ewes and the selection differentials applied). But some traits cannot be accurately measured until a certain age. For example, the effect of age on clean wool weight is still measurable at an average time of 12 months from birth but the effect is less at 15 months - so compromise (again) is required. However, there is a fairly good relationship between hogg fleece weight and future production of the mature sheep (this relationship is higher in Merinos and Merino crosses than in Romneys). There is a tendency for the repeatability to be lower with mature fleece weights, possibly as a result of an increase in temporary fluctuations in environmental effects.

<u>Practical Selection Methods</u> are of as great variety as the sheep themselves but it is suggested that the most efficient method in terms of annual genetic economic gain is to select rams on the basis of the reproductive rate of their dams and the ram's own clean wool weight at the age of 15 months (i.e. selecting on clean wool weight of twin born rams), and to select ewes on their dam's reproductive rate and clean wool weight at 15 or 26 months (i.e. saving all twin born ewes and making up the total with singles selected on clean wool weight). Ewe selection at 26 months still further decreases the age effect on wool and body weights and selection as shearlings is generally thought to be "easier" than at the hogg stage.

It is apparent therefore that, in order to assess a ewe's reproductive rate (either for ram or ewe selection) observations must be made in the field and controlled measurements taken when possible in order to be able to realistically compare potential breeding stock. The advantage of immense proportions - is that the farmer then selects sheep which are productive in his set of environmental conditions.

The independent cull process for selection on wool characters may be listed as follows:-

1. Cull on eye appraisal for those sheep showing obvious fleece faults or defects in anatomy (i.e. undershot jaw or entropion - turned in eyelid).
2. Weigh the greasy fleece weights of the remainder and rank the sheep according to merit;
3. Cull those with low fleece weights and obtain yield measurements from the remainder by scoring test samples. Select a further proportion on their clean fleece weights;

4. From those that are left, obtain detailed measurements of the fleece characters - staple length, fibre diameter, number of crimps per unit length. Then make final selection of sheep on the basis of their fleece quality.

Needless to say, not all farmers are able to select on all these measurements, but selection based on progress down the list results in more money in the pocket.

Progeny Testing, if properly carried out, gives an unbiased estimate of an animal's breeding value. But selection of individuals on the results of a progeny test does not always give the most rapid rate of genetic progress. The long generation interval between primary selection of an animal and its final use decided on the basis of its progeny's performance, means a slow rate of progress. The practical difficulties of devising accurate and meaningful progeny testing programmes are almost prohibitive especially where the character under examination is only revealed in one sex (e.g. milk production).

A system in which true random mating occurs is one in which any individual of one sex is equally likely to mate with any individual of the other sex and, in sheep, this implies that all males mate with an equal number of females. If the heritability of a trait is high, random mating following mass selection will lead to substantial genetic gain.

Therefore the larger the population, the more likely is random mating to avoid inbreeding which can then only occur by chance.

It has been said that the mating of related individuals is called linebreeding if it is successful and inbreeding if it is not! Nevertheless, inbreeding (or linebreeding) can be a useful method for increasing the genetic uniformity of a population but in general it leads to loss of thrift (inbreeding depression) a decrease if ovulation rate, disease resistance, fertility, fecundity and viability.

The crossing of two inbred lines results in heterosis (hybrid vigour) in which the offspring perform better than either of the parents for a particular characteristic. However, this phenomenon cannot be interpreted as demonstrating any superiority of inbreeding over other breeding systems such as selection and random mating. (In fact heterosis may only be a recovery from inbreeding depression).

Artificial Insemination in sheep allows the widespread use of outstanding rams (but firstly they must be proved outstanding and not just adjudged so to be on the basis of their looks) and its use for rapid grading up is desirable especially where there is a large difference between existing and projected production levels. It is widely used in the USSR and China and, to a much lesser extent, in South America.

With flocks of 3,000 ewes or more, AI shows an increase over natural mating in net annual genetic progress even though the rate declines with time through inbreeding, but with flocks of 1,000 or less the fall in net genetic progress under AI can be dramatic.

Artificial insemination programmes require relatively much greater capital outlay and recurrent expenditure than schemes based on selection (with recording) and random mating.

Traditional attitudes toward <u>flock structure</u>, with the pedigree flocks at the top of the tree followed by the stud and then the general (camp) flocks at the roots, imply that the flocks higher in the hierarchy have high levels of genetic merit than those lower down. If this is true, then there should be a fairly rapid rate of increase as rams with superior breeding value are used in the lower levels of the tree. But often the hierarchy does not reflect different levels of inherent merit in the stock and therefore there is little difference in genetic merit from top to bottom.

The age old attitude has been to try to improve from the top of the flock structure by using imported rams with supposed greater genetic potential. However, because pedigree and stud flocks are generally kept on better pastures and because of the relationship between actual appearance (phenotype), genetic make up (genotype) and environment it is incorrect to assume that these sheep would do as well in a different environment (Refer to the comparison between the Merino in New South Wales and the Bikaneri in Rajasthan). This attitude can be compared with the application of fertiliser to the leaves of a tree instead of to the roots - not much will reach the broad base of the roots from which the tree itself grows.

In a flock which is breeding its own ewe and wether replacements, the optimal balance of breeding and non-breeding sheep on the same area of land, will depend on:-

1. The level and pattern of reproductive rate which will determine the size of the breeding flock needed to produce the required number of wool growing sheep;
2. The difference in wool production between breeding and "dry" sheep;
3. The relative prices of wool and surplus sheep.

Analysis of these various factors will reveal the casting age which will give the greatest economic return. (For flocks breeding their own ewe and ram replacements. this analysis may show that rams should be used only 2 or 3 times and ewes 5 times).

Flock size is a factor which limits the rate of genetic progress - the larger the number of animals, the greater the chance of breeding on outstanding sheep (the better the root system of a tree, the better nourished and developed will be the timber); in a large flock it is easier to increase the intensity of selection; as the flock size increases, there is more potential for using more refined techniques of selection; any deleterious effects due to inbreeding can be avoided much more easily in a large flock.

Therefore large farms with extensively grazing flocks of sheep are in a well-placed position to operate breeding programmes based on selection of sheep most suited to their own environment.

There is little need to import "foreign" unproven animals except when a rapid major change is required in production traits or when, as will happen later rather than sooner (especially in a large flock), response to selection for measured production ceases due to exhaustion to available additive genetic variance (or possibly due to antagonism between natural and artificial selection.

The first step in formulating a breeding plan is to define its aims and to seek an increase in productivity by concentrating on measured production itself instead of trying to assess it through possibly related characteristics, or wasting effort on unproductive aesthetic features.

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A Nucleus Breeding Programme for Falkland Islands Sheep Farms

The accompanying article is submitted to the Falkland Islands Sheep Industry for discussion and comment.

It is not intended to be a "Bible" nor a directive but the launching point for a breeding programme based on genetic principles and selection of animals on the basis of measured commercial traits in a way which is quite compatible with existing farm management procedures.

It is hoped that by having a circulation to a wide range of involved parties in the Islands, that general interest in recording and improvement may be stimulated.

R. S. Whitley
27th March 1979

Project No. 3.6

A Nucleus Breeding Programme for Falkland Islands Sheep Farms

Summary

A ewe flock of proven genetic merit, replacements for which are provided by ewes recorded as performing best in camp, is used to provide rams for the ewe flocks.

The need for a logical breeding scheme for the Falkland Islands sheep industry is discussed. The necessity for such a breeding scheme to be based on measured and recorded commercial traits is stressed and the mechanics of a suggested Nucleus Breeding Programme are outlined.

It is pointed out that the large size of the ewe flocks in the Falkland Islands and the great variety of genetic material contained therein, means that there is no need to import animals from abroad.

A plea is made for more recorded information about the sheep already in the Islands.

A brief description of the New Zealand Group Breeding Scheme is given and a brief comparison with the suggested Nucleus Breeding Programme given.

The need for a logical breeding programme

Social and economic constraints being such as they are, we live in a society which demands, not only the maintenance of, but also an improvement in the general standard of living. With an economy based on the export of wool, the Falklands must produce this improvement either by increasing the proportion of the returns expended in wages or by increasing the returns themselves.

An increase in sheep production may be achieved by improving the quality and quantity of pasture production, improving the efficiency of utilisation of the pasture by grazing control and by improving annual performance on that pasture.

Within any population of biological organisms, be they bats or bacteria, there will be some which are better able to survive in one particular environment and there will be some less able to survive in that environment but the vast majority will be in between these two extremes. Now if we take a sample of the best grown bugs from a particular medium and let them reproduce they will form another population which will have a similar sort of variation as the original population but the starting off point will be at a higher level.

In the recent past, sheep genetics have been orientated about the "conformation" of an animal and breeders have based their improvement programmes on the principle that a certain type of sheep should have a particular conformation or appearance, and any sheep which did not have an acceptable appearance was bound to be inferior in its performance. Many breeders also had the (male chauvinist) attitude of insisting that the rams were all important and paid relatively little attention to the ewe selection.

This attitude of basing primary selection on conformation is equivalent to saying that because a sheep has the "correct" appearance when living on lush pasture in New Zealand or Tasmania, - an appearance which is supposed to mean a certain production performance, - it will perform as well itself, and its offspring will perform well when transported to (say) Port Edgar.

We have all been brought up in a world of sheep "improvement" in which the pedigree breeders have vested commercial interests in selection on conformation at the expense of other characteristics. But consider the variation in (say) face-cover in Merinos that there has been over the last twenty years. If a wool-blind Merino really does not perform better than a clean-faced one, why were they developed in the first place - purely a matter of changing opinions on that immeasurable characteristic - the "correct conformation" of an animal.

So sheep geneticists and breeders began to take a fresh look at the overall performance of various breeds of sheep under existing methods of selection, and they found that there had been little or no improvement in performance of flocks or breeds in terms of wool production, quality or in lambing performance. In fact one geneticist took a group of knock-kneed Merinos - an horrible sight to the conformationists - and found that they produced more wool and more lambs than the so-called "correct" Merinos!

If we examine two 10-year periods of production in the Falklands, the years 1948/49 to 1957/58 and 1968/69 to 1977/78, we find that there has been a slight increase in the average yearly lamb marking percentage but a slight decrease in the average yearly greasy wool weight cut per sheep shorn (shown in the table below). Now if it is accepted that, within the range of qualities of wool produced in the Islands, the economic weight attached to wool yield per sheep is greater than that for wool quality, either the total number of sheep must be increased or their individual performance must be improved.

10 year period	Av. number sheep shorn	Av. greasy wool weight per sheep	Av. number breeding ewes	Av. lamb marking %
1948/49 - 1957/58	536441	3.68 Kg	222589	61%
1968/69 - 1977/78	568301	3.64 Kg	220208	64%

So although the total production of wool has increased over the 20 year period, due to an extra 32000 sheep producing an average of 2.97 Kg greasy wool, the average increase in production per year is approximately 0.0035 Kg/hectare/year. It is a matter of simple arithmetic to relate this to the annual increase in cost of production per hectare per year.

It should be remebered that the efficiency of production is always greater in higher producing animals and selection of a breed or strain based on wool weight per head would also mean selection of a more efficient one. Falkland Island selection processes have lead to a greater number of slightly less efficient sheep in the 1970's than in the 1950's.

Principles of a breeding programme

A successful breeding programme should be based on three fundamental principles:-

1. Appearance is not a reliable guide to the value of a breeding animal;
2. The emphasis is placed on breeding only for those characteristics which are important for commercial production;
3. Selection must be based on quantified measurements made on sheep living in the extensive environment (i.e. not living in selected areas such as stud flock camps).

There are several important factors to bear in mind when formulating a breeding plan (with particular reference to the Falklands):-

1. The requirement is for sheep which not only survive but most efficiently produce a saleable end-product which is usually wool (but may be living sheep of any age);
2. Production characteristics - reproduction rate, wool quantity and quality are controlled by heritable and correlated factors;
3. Conditions of environment (including management) vary from one farm situation to another and it is incorrect to assume that (for example) a well grown ewe on Carcass Island which produces and rears a pair of heavy twins and cuts $4\frac{1}{2}$ Kg wool would do the same if she were kept at Bluff Cove;
4. Dry sheep produce more wool than do "wet" sheep. Thus the fewer the numbers of reproductive sheep, the more land can be made available to dry sheep which produce the greatest profit. The proportions of dry and wet sheep really depend on the relative prices of wool and surplus sheep and the selection differential required for the improvement of the stock. The greater the selection differential, the more rapid is the genetic progress;
5. In a large flock there are greater numbers from which to choose the breeding stock than in a small flock. Selection can then be compared to someone who wishes to buy a radio cassette player which is composed of several interrelated components: the sensible man goes to a shop which has very many different models and picks that which suits his own particular requirements and operates well in his own set of conditions. The foolish man goes to a shop with only a few models, buys one which looks nice and hopes that it works well when he gets home.

In the formulation of a breeding plan it must be remembered that the flock structure of each farm varies and depends on the level and pattern of reproductive rate (i.e. how many ewes are needed to provide the required number of wool growing sheep; the relative price of wool and surplus stock; the difference in wool production between breeding and dry sheep). A further consideration, of course, is the annual death rate in all classes of sheep.

Formulation of a Nucleus Breeding Programme applicable to Falkland Island management systems

It is impossible to describe a breeding programme which exactly fits each farm situation and each type of management. However there follows the basis of a Nucleus Breeding Programme which is founded on the genetic principles outlined in a previous paper (Ref:1) and on the points made already in this paper. The change from traditional breeding practices to such a programme cannot be immediate but will be a gradual process, but the sooner a start is made, the sooner will be the economic benefits.

At each and every stage, there is room for discussion on the points made but it is hoped that, by accepting the general principles, ways round difficulties may be found. Apart from some of the smaller units and as opposed to many farms in New Zealand and the United Kingdom, Falkland Island farms have a large enough population from which to select their "improved" genetic material without having to resort to the importation of "foreign" un-proved animals unless large and rapid changes in (say) quality of wool are required.

Camp Ewe Flocks

Let us start with the root system of the Falkland Island Sheep Industry - the camp ewe flocks. From this broad base we wish to select ewes which have proved themselves capable not only of producing but rearing good healthy lambs to the weaning stage. In general those that rear twins are the aim because, although the survival rate is lower among lambs born as twins, it is always higher than half that for singles. But it may be argued that under Falkland Island conditions one good strong weaned lamb is better than two less strong ones when the condition of feed over their first winter is poor. So we come to the idea of measuring the total weight of lamb produced by a ewe. However, the repeatability of one lambing record is much lower than that for several. But we must compromise between having highly repeatable information based on many lambing records and the need to reduce the time gap between a female sheep becoming productive, proving herself in camp conditions and finally being selected for inclusion into the nucleus flock (which contains the proven genetic material).

The practical difficulties of detailed lamb recording in a camp ewe flock are immense, so we must compromise and limit the numbers and methods of measurements.

Selection when the ewes are two years old, on the basis of their wool quantity and quality, will be less influenced by their age since birth than selection at one year old.

Primary selection for obvious fleece and anatomical faults, with secondary selection for greasy wool weight, tertiary selection for fleece character - staple length, fibre diameter, crimp number - (and possibly selection on yield), will produce a number of gimmers which can then be followed through to observe their reproductive performance. The precise number of two shear ewes thus selected will depend on such factors as the number originally available, the selection pressure applied and the number of animals with which the farm can cope when recording is necessary.

If the female sheep are well enough grown to be mated as shearlings then the initial selection will be at the hogg shearing stage at about 12 - 13 months of age. Selection in either case, can be made on the basis of wool production characteristics at first or second shearing.

These selected two-shear ewes (i.e. those of good wool quantity and quality) are then numbered with either a spray or raddle number or code on their flanks which corresponds to their ear number (Richey mini tags are suggested). These sheep then run in camp with the rams under the normal camp conditions (i.e. in the maiden ewe flock or general camp ewe flock).

During the period up to weaning, the ewes and lambs should be observed and records made of those ewes which have had lambs, how many lambs each one has produced and a visual appraisal made of the lambs' condition, i.e. excellent, very good, good, average, mediocre, poor (or a scale from 6 - 1). These observations and records should be made prior to any interference, such as lamb marking, and are particularly important during the period immediately prior to weaning. In this way it is possible to build up a background of measured information on which selection is based.

If possible, the lamb(s) belonging to a particular ewe should be identified with that ewe by an eartag or a system of dye marking, but the speed at which lambs over 12 hours old can move means that this process is obviously difficult to perform in open camp and would call for very high quality shepherding and dog control even with tame sheep and with some system of applying dye at a distance. But the value of precise lamb weight information is considerable. However, to start off with, the selection should be for those ewes which have produced twin lambs and have managed to rear them, and the refinement of weighing can come later when the system is under way.

All these maiden ewes then come in for shearing and all fleeces are weighed and quality measurements made (if possible). The numbers are re-applied to their flanks and the process is continued until they have had three crops of lambs and have been shorn four or five times depending on the system of management.

The number to be selected depends on the figures available from the records and the best of these ewes will then go into the nucleus flock because they have shown that they have the genetic potential to produce and rear lambs in camp conditions.

A production index can be formed from the total number of lambs reared by a ewe (or total weight of lambs, if available) and the total fleece weight and average quality measurements over the three crop period. However, because of the reasonable relationship between the shearling fleece weight and future wool production, it is possible that selection for wool can be based on measurements made only at that shearing. The recorded and filed production index of each ewe in the Nucleus flock means that by easy referral she may be replaced by a younger ewe with a better production index. The fluid situation of an improved breeding programme should mean that replacement of ewes in the Nucleus flock is a regular occurrence. (See Appendix 1).

A further method can be introduced and that is to mark as many of the general camp ewes (i.e. those not selected as shearlings and marked on their flanks) which produce twins. These can be used, if necessary, to make up numbers for the nucleus flock remembering that they have lower quality wool ratings because they were not initially selected for their wool quality or quantity.

So to summarise so far:-

1. All ewe shearlings are put through a process of independent culling levels to reveal those with the best wool weight and quality. Detailed measurements are made;

2. The best are eartagged and flank marked then turned into open camp;

3. Observations and records are made as close to weaning as possible over the period of three lamb crops;

4. The best of these ewes enter the nucleus flock replacing those ewes with lower production indices;

5. The remainder stay in the camp ewe flock for the rest of their lives, or, if they are barren or have a very low production index and yet are of high wool quality they could enter a dry ewe flock.

Therefore, at any one time, there will be three groups of "high" wool quantity/quality ewes which are marked and about which detailed records are being made, and one group of young sheep awaiting selection for recording.

One further selection method can be used on the camp ewe flock. Amongst those ewes which are not of special wool quality (i.e. those not selected at two years old for detailed recording) it is possible to select against barrenness. In this situation, a ewe is barren if she does not rear a lamb to weaning and can be adjudged by the state of the udder (as long as weaning is not when the lambs are too old). It is reasonable to give a ewe one chance to redeem herself and then she may be culled or sent to the dry ewe flock depending on the quality of her wool. The number of years for which a ewe is allowed to be barren depends on the selection pressure, i.e. on the number of replacements available.

The method for this recording is simple: On the basis of examination of the udder a barren ewe is sprayed or raddle marked. If she is barren again the next year, then out she goes.

However, it is wise to remember that the rate of genetic gain is greater if selection is for a characteristic (such as twinning) rather than against one (such as barrenness).

The Nucleus Flock

If we now turn to the Nucleus flock, we can see that it is composed of those ewes which have proved themselves better than average at rearing lambs whilst having high wool quantity/quality. (Note that "high" is only with reference to the particular desire of the farmer). None of the ewes is in this flock by birthright, only by merit, and any one may be "demoted" to the camp ewe flock if a ewe with a higher production index appears from the groups of camp ewes being recorded. (See Appendix 2).

But until that happens, that ewe in the nucleus flock can stay there producing lambs almost until she dies from natural causes (or for humanitarian reasons) because we know that she has better than average genetic material for those particular environmental conditions in which she proved herself. (If a ewe becomes barren whilst in the nucleus flock, she can be culled, or join the dry ewe flock - so observations are required. She can be given two chances, then out).

The ewe lambs from the nucleus flock join the camp flock ewe lambs and all are submitted for selection at two years old. Selection is only on measured production characteristics of sheep run in camp conditions, and not on the birth weight of the lambs which is influenced by their dam's nutritional plane.

Ram lambs born in the nucleus flock will obtain half their genes from their mothers which we know have proved themselves in camp. By definition, therefore, these lambs, provided they have no gross defects for which they may be culled at marking/weaning, have a good genetic potential for survival in camp and so are used to form the ram flock. Although little selection of the rams is required if the rate of replacement of the ram flock is high, primary selection is for those ram lambs born as one of a twin and secondly for wool quantity and quality at shearing. Obviously, therefore, some sort of basic lamb recording is required in the Nucleus flock.

To summarise the nucleus flock:-

1. It is composed of camp ewes which have proved themselves better than average;

2. Continued presence in the nucleus flock is only by comparative merit and may cease at any time.

3. These ewes are used for breeding for as long as possible;

4. All ewe lambs join the general hogg flock;

5. Weaning and marking are at the same time;

6. Ram lambs are selected for twinning (followed if necessary at 12 months for wool quality and quantity).

Ram Flock

Turning now to the ram flock, we see that all its members come from the nucleus flock which means that they are born from mothers of proven quality. It will be remembered that, because we are always improving the nucleus flock, the genetic material carried by each year's crop of ram lambs will be improving. This means that the more rapid the rate of ram replacement, the greater the rate of genetic progress and, in general, it should be unnecessary to keep any ram for more than two or three breeding seasons. The fluidity of the situation depends on the rate of replacement of the nucleus flock with better proven ewes and this in turn depends on the numbers of ewes selected at two years of age and about which detailed records are kept.

If large changes in wool type are required, it may be justifiable to retain a ram of exceptional wool quality/quantity in the ram flock for a longer period, but in general it pays to be ruthless.

The entire farm ram flock is treated as equal and are randomly divided to mate with either the nucleus flock or the camp ewe flock. In this way inbreeding is less likely to occur.

Summary of the ram flock:-

1. All members come from the nucleus flock;

2. The greater the rate of replacement, the greater the genetic progress;

3. Random division of the ram flock between nucleus and camp ewe flocks reduces the chance of inbreeding.

Wether Flock

The wether flock is composed of all the male lambs from the camp ewe flock and those rejected from the ram flock.

DISCUSSION

It will be apparent to those who have read about breeding programmes that that which has been described here is not identical to the type of Group Breeding Schemes about which we hear so much from New Zealand and which arose as a reaction to the lack of interest in commercial traits shown by most pedigree ram breeders.

The general form of a Group Breeding Scheme is that a group of co-operating breeders record their animals on their own farms and select their best performing ewes and send them to the jointly-owned nucleus breeding unit. Here there is further recording and selection and the best young males and females are retained for breeding in the nucleus flock. Other selected young males from the nucleus are used in the co-operating farms as replacements.

The main differences between the application of Group Breeding Schemes in New Zealand and the Falkland Islands are due to scale of flocks, stocking rate, to lack of history in recording animal performances and absence of such data.

In 1976, in New Zealand there were 26 sheep breeding groups with 310 members screening an average of 1600 ewes per member. There were also 6 cattle groups with 142 members screening about 58,000 cattle. Some members "contributed" as few as 500 ewes to their group.

So in comparison with New Zealand, many Falkland Island farms are, in themselves, the size of a "group" and could operate a "one-man" group breeding scheme which has been called a Nucleus Breeding Programme because the nucleus flock is at the centre of a vigorous selection procedure involving measured commercial traits.

Logical progression through this dynamic process of selection for success in a particular environment leads to the realisation that only very infrequently is there any need to import sheep from another farm - let alone from another country - as long as the broad base of the selection process - the camp ewe flock - is large enough. These circumstances occur on nearly all the mainland farms but not on some of the Islands which could justify forming themselves into a Breeding Group.

When substantial changes in wool quality are required, input of new genetic material is justified as long as these animals prove themselves capable of this so-called improvement when exposed to the same environment as that which their offspring will have to endure. Thus there is justification for importing ewes, and not rams, into the camp ewe flock so that they may prove themselves (or fail to do so) in open camp, not in some specially reserved nutritively improved area. Only when they have proved themselves may they receive preferential treatment.

The Nucleus Breeding Programme outlined above is described in its simplest form but has the facility for continuing development and improvement should that be desired by the farmer. As long as the basic principles are adhered to, the returns, in the form of genetic gain, should be proportional to the effort expended on the selection procedures.

What we have in the Falklands are Corriedale type and Romney type Falkland Island Sheep which have, through natural selection, just about become the epitomy of "easy-care" sheep. In general terms, it does not really matter what the animals look like as long as they are healthy and produce the goods - wool.

The rate of gain (ΔG) in selection for a particular trait may be expressed in the fearful looking formula:-

$$\Delta G = \frac{SD_m h^2_t + SD_f h^2_t}{Lm + Lf}$$

Where h^2_t is the heritability of a trait;

Lm is the age of the males at which their offspring are born;

Lf is the age of the females at which their offspring are born;

and SD_m, SD_f is the selection differential applied to the males, females.

But the selection differential is equal to ($\bar{X}s - \bar{X}pop$) which is the amount by which the average of the selected group ($\bar{X}s$) differs from the average of the population ($\bar{X}pop$) from which they were selected.

But, in the absence of recording of any individual animals for wool weight, lamb production or any other commercial trait, it is impossible to say with any certainty if the breeding programme on a farm is going backwards or forwards.

2nd April 1979

It is reasonable to suppose that if the system of grazing the sheep is improved to provide better nutrition with a view to increasing production of lambs and wool, that those ewes on the previous system will respond sufficiently to meet the financial cost of the alteration/improvement. The extent to which their performance improves depends upon similar alterations on the remainder of the farm, i.e. the provision of improved nutrition for hoggs and shearlings if total flocks expansion is contemplated. (Ref. 2)

There are few sets of circumstances where one should consider selecting those ewes performing well in circumstances where the level of nutrition is above the average for the ewe camps on the farm.

If however a large programme for any form of re-seeding designed for ewes and lambs and additional dry sheep is planned it would be wise to estimate that level of nutrition that can reasonably be expected and the selection should therefore be made from ewe camps better than the present estimated average.

C. D. Kerr

Appendix 1

SPECIMEN RECORD SHEET

				LAMBING RECORDS									
	2 Years			1		2		3					
EWE NO.	BODY WEIGHT	BODY CONDITION	GREASY WOOL WEIGHT	SCORE	SCORE	SCORE	SCORE	SCORE	SCORE	TOTAL NO. LAMBS	TOTAL SCORE	INDEX	FATE

An example of the minimum records necessary for the selection of ewes by the Nucleus Breeding Programme.

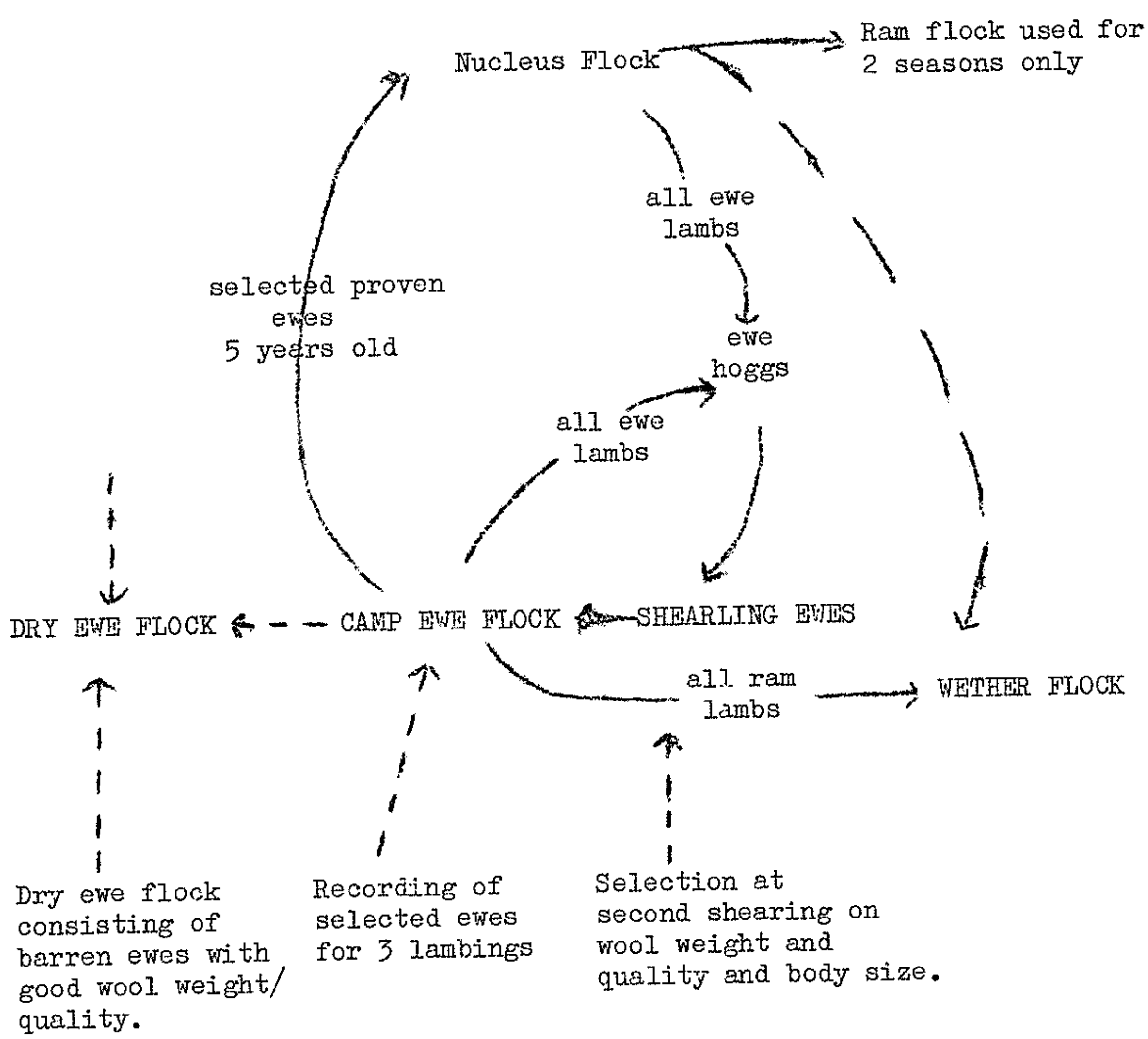
As the programme develops additional criteria for selection may be included, e.g. clean fleece weight, yield, fibre diameter, staple length, crimp number, lamb weaning weights etc.

Appendix 2

DETAILS OF FLOCK STRUCTURE

The flock structure will depend on a balance between the various components:-

1. The nucleus flock provides the rams for the ram flock;
2. The ram flock mates with the camp ewe flock and the nucleus flock;
3. The wether flock is replenished by all ram lambs from the camp ewe flock (plus a few from the nucleus flock);
4. Annual death rates vary from farm to farm. Therefore precise prediction is impossible;
5. The structure will change as lambing percentages improve;
6. The size of the nucleus flock depends on the rate of ram replacement.



Therefore:-

If the camp ewe flock contains 1000 animals, 33 rams are required. If the rams are retained for breeding for 2 seasons only then the annual requirement is for 16 rams (+ some for the nucleus flock and some for losses, culling etc.). If the lambing percentage is 100% in the nucleus flock, approximately 40 ewes are required.

Appendix 2 cont.

The camp ewe flock of 1000 at 80% lambing 10% loss in the first year and then 5% loss/year would support a total wether flock of about 1900.

The number of selected hoggs and shearlings which are put forward for detailed recording, will depend entirely on farm management and selection differentials required.

Appendix 3

Reference: (1) Some notes on factors concerned in the formulation of a breeding plan for sheep flocks. Whitley R. S. 1979

(2) Flock Expansion and its Financial Effect Calculated with an Investment Appraisal Technique. Kerr GTU 14.3.78

Further reading: Sheep Farming Annual (1974). The First Conference of the New Zealand Federation of Livestock Breeding Groups.

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The Sheep and Cattle Industries of the Falkland Islands. Davies T. H. et al (1971)

NOTE ON NUCLEUS BREEDING SCHEME FOR THE FALKLAND ISLANDS C.D.K. 6/8/79

Summary

Examination of Records from 1.1 Salvador 73 age ewes and 73 age ewes from 3.2 Fox Bay East indicate that it is probable in the commercial situation to select ewes for the Nucleus Flock that have weaned a lamb successfully in three (3) successive years. Several opportunities (3) are available for selection for wool quality and and wool weight and any other desirable trait. The selections indicated below result in 8.3 per cent of the original maiden ewes mated joining the Nucleus Flock. A suggested selection procedure diagram is at Appendix 3.6.

1. The availability of performance records over three years of 73 age ewes from 1.1 Salvador and 3.2 Fox Bay East has permitted an estimate to be made concerning the possibility of the Flockmaster being able to select ewes, in sufficient numbers, that have successfully weaned lambs in three successive years (Eadie 78).

1.1 Salvador

year	73 age ewes mated	weaned a lamb	age group weaning percentage
76/77	48	27	56.2
77/78	42	20	80.1
78/79	37	15	67.6

That is to say $\frac{15 \times 100}{48}$ = <u>31% of those mated in year one can be expected to wean a lamb in three successive years</u>.

2. The weaned weight of lamb at 1.1 Salvador when totalled over three years varied between 62.5kg and 92kg. A number of corrections could be made concerning birth dates, sex of lamb etc., but in no case was the individual lamb weaning weight "unacceptable" and no other ewes could compare in terms of total weaned lamb weight with ewes producing weaned lambs in three successive years.

3. Of these fifteen (15) ewes at 1.1 Salvador nine (9) were found to have produced 4kg greasy wool per year, and their totals varied from 13.40kg to 17.48kg over the three years.

4. From these records it seems possible for the Flock Master to select:-

a) Approximately one half of those youngest age ewes successfully weaning a lamb in year one for:-

i) having weaned a lamb
ii) wool quality
iii) wool weight

b) This population is reduced by 26% (25% Fox Bay East) in year two when those not successfully weaning a lamb are excluded;

c) A further reduction of 25% (30% Fox Bay East) can be expected to occur in year three when those not successfully weaning a lamb are excluded.

The Flockmaster should after the third season have for consideration approximately twice as many candidates for the Nucleus Flock as required. If the population at this stage is then halved, i.e. reduced by 50% the number finally selected is:-

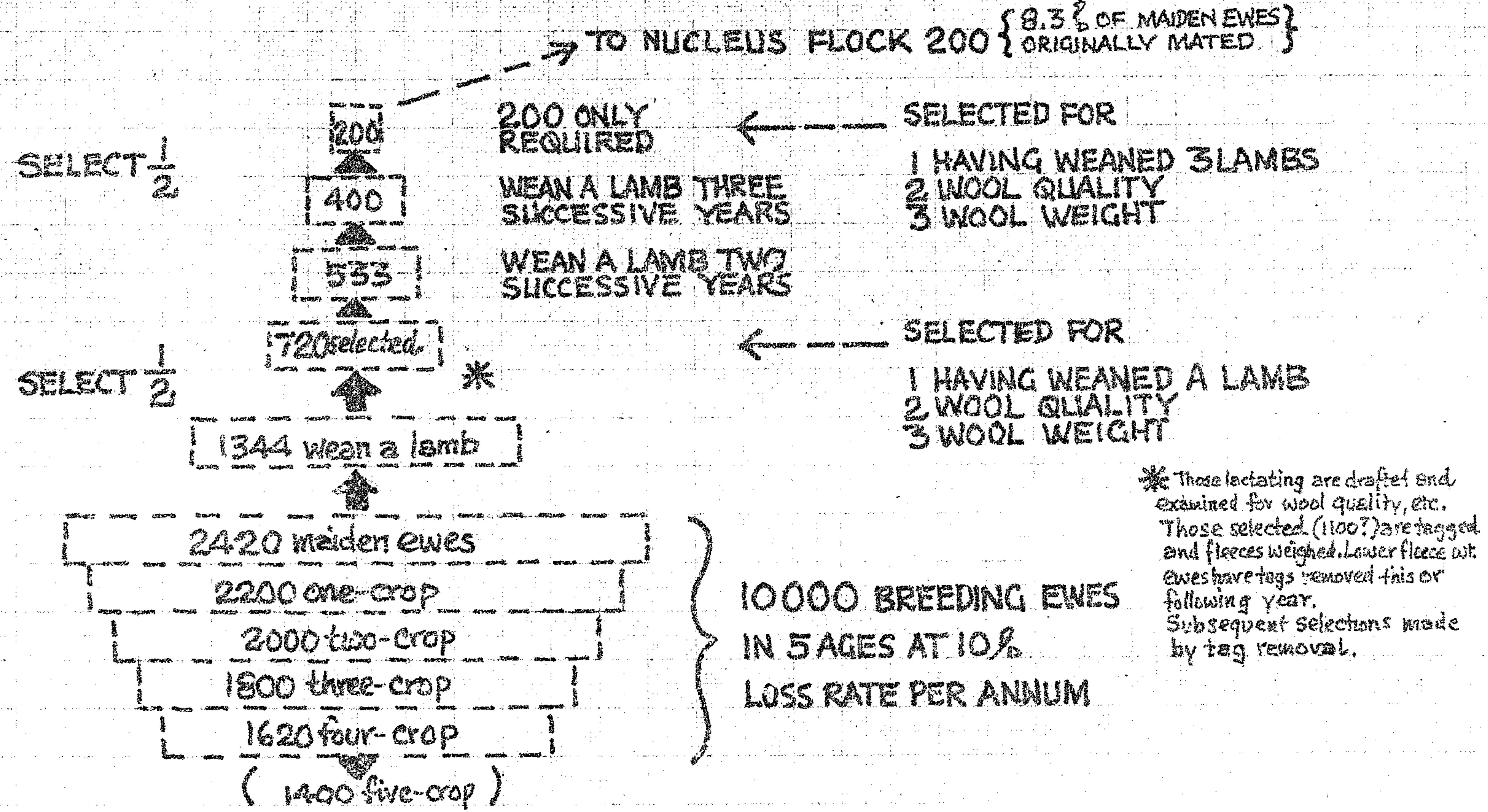
<u>8.3 per cent of those maiden ewes mated in year one</u>

Provisos:
i) 3 ages only of ewes are run in the Nucleus Flock (3, 4 and 5 crop)
ii) The weaning percentage of the Nucleus Flock is 75%
iii) Four-fifths (80%) of the ram lambs weaned are retained.
iv) Ram lambs are used as sires for the Nucleus Flock.
v) Only 3 ages of rams are used in the Ram Flock (1-2-3 shear only).
vi) The loss rate in the Nucleus Flock is assumed 10% and in the Ram Flock 25% per annum.

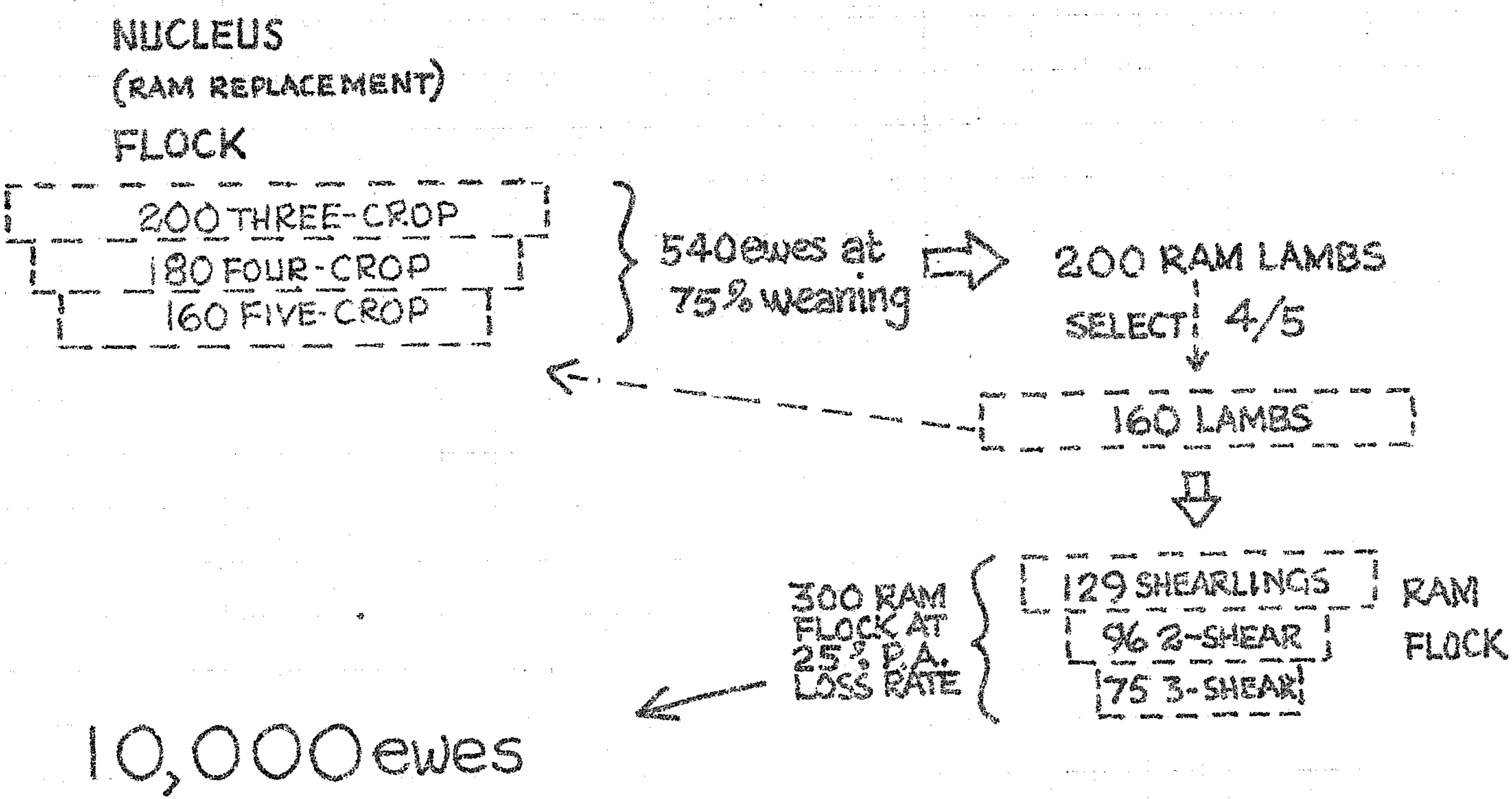
NUCLEUS BREEDING SCHEME: SUGGESTED SELECTION PROCEDURE

3.6

(USING DATA OBTAINED FROM 1.1 and 3.2 1976-79)



NUCLEUS BREEDING SCHEME : THE NUCLEUS AND RAM FLOCKS



REPORT INTO THE PROGRAMME OF ARTIFICIAL INSEMINATION OF COWS IN THE FALKLAND ISLANDS BETWEEN JANUARY AND APRIL 1978.

SUMMARY: A brief history is given of the factors which led to the inception of the A.I. programme. The logistical and managemental problems are outlined and reasons given for its expected limited success. Some thought is given to possible future A.I. programmes. Details of the semen imported and a financial balance sheet are given.

1. INTRODUCTION: During "Farmers Week" in July 1976 enquiries were made as to the possibility of importing frozen bovine semen for use in an Artificial Insemination (A.I.) programme. The availability of synthetic prostaglandins to Veterirary Surgeons made the proposals more realistic than would otherwise would have been the case.

Over the past few years, several farms have acquired A.I. equipment and semen for their own programmes. The practical knowledge of insemination technique has been acquired by attending, in England, the Milk Marketing Board's courses of instruction.

A.I. was first used in the Falklands by Mr. C. T. McCrea M.R.C.V.S. in 1969 and on this, as on subsequent occasions, the success was limited due to the difficulty of obtaining a regular supply of liquid nitrogen in relation to the number of cows coming into season at any one time.

2. ORGANISATION: In October 1976, a circular was sent to all farm managers to try to assess the interest in an A.I. programme and to reveal the interest in different cattle breeds. A very limited number of replies were received and most of these were vague both with regard to numbers of cows for insemination and breeds required. Further information was obtained from the farm managers by verbal questioning.

In May 1977, a report was submitted to the Falkland Islands Government and the Sheepowners' Association on the feasibility and logistics of an A.I. programme. Approximate costings were also submitted.

During "Farmers Week" in June 1977, the S.O.A. indicated that they were still keen and interested in the programme and gave verbal assurances of financial and logistical backing. It was agreed that a charge of £10 per cow inseminated would be acceptable.

Later F.I.G. suggested that the whole scheme be put up for expert opinion from the Ministry of Overseas Development but by that time the semen had been ordered following a check of the continued interest among farmers and of numbers and breeds required.

In September 1977, a further circular was sent to all the farms participating in the scheme informing them about the timescale of the A.I. procedure, the handling and choice of cows to be inseminated.

In January 1978, 370 straws of bovine semen arrived by sea.

3. OESTRUS SYNCHRONISATION: In order to reduce the number of visits to farms, and therefore reduce the time spent travelling and the number of Beaver flights required - and so be able to accommodate more farms in the limited time - it was decided to issue I.C.I. Estrumate to the farms to perform the two injections themselves. The Estrumate was issued in January 1978 along with instructions as to its use and safety precautions necessary. It was considered expedient to visit some farms to perform these injections because either this would enable other work to be performed at a time more suitable to the farm, or the farms were unsure of the pregnancy status of the cows to be inseminated, or the farm personnel were considered unpractised in injection techniques.

4. EQUIPMENT: Although there was, at the time of organising the A.I. programme, a variety of A.I. equipment already in the Islands, only one farm - Port San Carlos - was prepared to lend their three cylinders for the benefit of the scheme. Other farms either wanted to sell or hire their equipment.

Port San Carlos supplied, free of charge, one XR-16 storage cylinder, one liquid nitrogen storage flask and a small "30 day" cylinder.

Although some equipment was available from the Grasslands Trials Unit (e.g. thermometer, scissors, forceps, protective clothing), it was necessary to purchase the catheters, plastic sleeves etc. from the M.M.B. in U.K. Details are given in the balance sheet.

It was decided to obtain the semen from the M.M.B. Export Section and have it shipped out by sea freight and for this purpose the XR-16 and storage flask were sent to U.K. Sea transport was chosen rather than air freight because of the possibility of delay in trans-shipment at either of the two intermediate Airports in Argentina. The possibility, together with the fact that the cylinders would have been flown at about 30,000 feet in an unpressurised compartment, meant that the risk of loss by sea was less than by air.

On arrival in the Falklands, the semen was tested and was found viable. However, the liquid nitrogen levels in the two cylinders were low, so it was decided to Place the semen in the 30 day cylinder and to use the other two as nitrogen reserves. When the liquid nitrogen storage flask was emptied, it was sent to the Embassy in Buenos Aires for replenishment by La Oxigena. It had been hoped that rapid transport to B.A. and back to Stanley would be assisted by official sources but this proved impossible and the cylinder was absent for 3 weeks before coming back on H.M.S. Endurance. On arrival it was found to be about $\frac{2}{3}$ full. (The local L.A.D.E. office had previously indicated their unwillingness to carry the full cylinders but suggested that the Head Office be contacted for their views. No further action was taken).

The M.M.B. had been requested to ensure that all the straws, catheters, plastic sheaths and other equipment were of compatible size but it was discovered that some straws were $\frac{1}{2}$cc but the majority were $\frac{1}{4}$cc. Consequently an adaptation to some equipment was necessary and this was only partially successful. The M.M.B. sent their profuse apologies and undertook to supply the correct size pieces (free of charge). Unfortunately these arrived after the termination of the programme.

5. PROBLEMS ENCOUNTERED: in the A.I. programme included the logistical problem of the right personnel reaching the cows with all the equipment in time for the insemination, the farm organisation for animal handling and the problem of the wrong size straws.

The logistical problems were considerable and, when allowing for bad weather, aircraft maintenance, other aircraft duties, the only reason why there was but one farm which had to abandon the A.I. because the inseminator could not reach the cows in time, was due to the fact that as much travel as possible was done overland. A secondary benefit of this mode of transport, although rough and hazardous for the semen container was that the liquid nitrogen was not subjected to rapid changes in atmospheric pressure which influences the boiling rate.

On some farms the facilities for the handling and insemination of the cows were good, the primitive and rudimentary conditions under which cattle are often managed leads to considerable animal (and inseminator) stress which will result in reduced conception rates.

Many of the animals presented for insemination were in poor condition further reducing the chances of successful insemination. Although insemination of such animals was thought to be wasteful, the procedure was performed as there was a slight chance of success and the semen only had a limited, and unguaranteed life.

On one farm, the inseminator was assured that the cows could not possibly be in calf, but, nevertheless, one cow aborted a living calf after the first Estrumate injection and another was found to be pregnant when presented for insemination.

Due to the failure of two Beaver flights, it was found that the reserves of liquid nitrogen were exhausted and the semen subsequently died on 31st March. It had been planned that these two flights would enable a check to be made on the nitrogen levels and fresh supplies obtained if necessary. Consequently, the A.I. at Port Howard was totally abandoned and, although the cows at Fox Bay East and Dunnose Head were inseminated, the chances of success are minimal. Semen for Douglas Station was also lost but this was not part of the A.I. scheme based on oestrus synchronisation and the purchaser had failed to collect the semen in good time.

It had been hoped to pay Port San Carlos for the use of their cylinders, but this has proved impossible.

6. FUTURE POSSIBILITIES: The success or failure of this programme can not yet be assessed but a calving rate of 35-40% would be very acceptable - bearing in mind the points made above. However, the crossbred animals so produced are very much cheaper (although not pure) than the importation of live animals.

The success of the variety of breeds used in the scheme will only be assessed in years to come but the use of such breeds and the operation of the programme has helped, it is hoped, to stimulate interest in the operation and function of cattle breeding.

In future, more attention should be paid to discussion about choice of breeds with the farmers. This can only be done by verbal questioning as circulars and questionnaires do not receive replies.

If an artificial insemination programme is repeated, the following details should be considered - (1) the inseminator and the programme should be under Veterinary supervision; (2) the use of synthetic agents (e.g. prostaglandins) greatly facilitates the performance of such a programme; (3) cows and cow management should be carefully screened with an emphasis on insemination on those farms which have a definite breeding policy and recording scheme; (4) preferably farms should present 10 or more cows for insemination at one time (several farms could "share" the cows); (5) selection of the cows and bulls must be on health, suitability to the environment and production aims; (6) the problem of regular supplies of liquid nitrogen must be resolved.

7. DETAILS of the imported semen and a balance sheet are attached.

8. ACKNOWLEDGEMENT is due to Mr. A. Miller of Port San Carlos for the loan of cylinders and to Mr. E. W. M. Carden of the Milk Marketing Board for his help and advice.

R. S. WHITLEY B.V.M. & S., M.R.C.V.S.
14th April 1978

Summary of Progeny of Artificial Insemination Porgramme

1978

Farm	Breed	Males	Females	Twins	Total Calves	Cows Available
Darwin (Dairy herd)	Ayrshire (Pant Outlaw)	3	5	1 mixed	10	
	Burnockstone (Westside Charm)	3	5		8	30
(Beef herd)		one unidentified calf thought to be from AI				
Fitzroy	South Devon	2			2	6
Hill Cove	Lincoln Red		1		1	4
Roy Cove	Lincoln Red	1	1		2	6
Pebble Island						5
Port San Carlos	Ayrshire (Blue)	1				
	Lincoln Red	1	1			
	Simmental	1			4 (possibly others)	24
Port Stephens	Welsh Black	2	1		3	9
Johnson's Harbour	Ayrshire (Pant Outlaw)	1	1		2	2
Green Patch						4
Rincon Grande	Devon	1				
	South Devon	1	1		3	12

It should be noted that the records of the Darwin beef herd and the Port San Carlos herd are incomplete.

APPENDIX 1

SEMEN IMPORTED INTO THE FALKLAND ISLANDS, JANUARY 1978

BREED	NAME OF BULL		NUMBER OF STRAWS
AYSHIRE	BURNOCKSTONE WESTSIDE CHARM		50
AYRSHIRE	PANT OUTLAW		50
DEVON	BOVEY LONELY 1ST		40
LINCOLN RED	DONNINGTON TROOPER		40
LUING	LUING SWIFT		22*
LUING	LUING ROCKET		19*
SIMMENTAL	MMB PILOT		20
SOUTH DEVON	WINDSOR SLAM 2ND		40
SUSSEX	HINKLEY GLOW-WORM		40
WELSH BLACK	TRYFAL EBRILLWR		50
		TOTAL	371

(* Although 20 straws of each Luing Swift and Luing Rocket were ordered, those supplied are as shown).

DISSEMINATION OF STRAWS

134	cows were inseminated twice	=	268 straws
13	cows inseminated twice with straws suspected dead	=	26
4	straws used for testing purposes	=	4
3	straws accidentally damaged on farms	=	3
70	straws lost when liquid nitrogen evaporated	=	70
			371

APPENDIX 11

RECEIPTS

(i) based on charge of £10 per cow inseminated.

	£
ROY COVE	60
DARWIN	600
TEAL INLET	30
FITZROY	60
PORT STEPHENS	80
PORT STEPHENS	10
HILL COVE	40
PORT SAN CARLOS	250
RINCON GRANDE	140
FOX BAY EAST	130
GREEN PATCH	40
PEBBLE ISLAND	60
JOHNSONS HARBOUR	20
TOTAL	£1,520

(ii) based on a charge of £10 per cow inseminated plus additional use of Estrumate

PORT HOWARD 136.80

(iii) based on cost price plus a handling charge

DOUGLAS STATION 93.00

TOTAL RECEIPTS £1,749.80

PAYMENTS

(i) MILK MARKETING BOARD

370 DOSES OF SEMEN	890.00
25 LITRES LIQUID NITROGEN	6.25
4 INSEMINATION CATHETERS	18.00
480 INSEMINATION SHEATHS	12.00
2 STORAGE CONTAINERS COLLECTION & DELIVERY etc.	121.82
TOTAL	£1,053.07

(ii) VETERINARY DRUG COMPANY, YORK

ESTRUMATE 385.40

(iii) L.A.D.E.

AIR FREIGHT 4.24

TOTAL P/MENTS £1,442.71

REPAYMENTS

PORT HOWARD	136.80
TEAL INLET	30.00
FOX BAY EAST	130.00
TOTAL RE/P/MENTS	296.80

TOTAL RECEIPTS	£1,749.80	TOTAL PAYMENTS	£1,442.71
		TOTAL REPAYMENTS	296.80
	£1,749.80		£1,739.51

BALANCE £10.29